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ABSTRACT

This booklet is the fourth of a series of 16 booklets that together describe and present findings for a study which involved field observations and a survey of science teaching and learning in American public schools during the school year 1976-77. The study was undertaken to provide the National Science Foundation with a portrayal of current conditions in K-12 science classrooms to help make the Foundation's programs of support for science education consistent with national needs. Eleven high schools and their feeder schools were selected to provide a diverse and balanced group of case study sites. One field researcher was assigned to each site and instructed to find out what was happening and what was felt important in science (including mathematics and social science) programs. The case study report from a suburb of a large midwestern city is contained in this booklet. Science education is the primary focus of the document. (MN)

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Booklet III
Science Education in the Alto Schools
Louis M. Smith

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270 Education Building
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BOOKLET III

SCIENCE EDUCATION IN THE ALTE SCHOOLS: A KIND OF CASE STUDY

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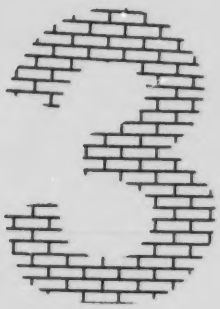
June 1977



Alte is one of the oldest suburbs of a large midwestern city, but has developed an impressive commercial trade center in recent decades and has a very substantial tax base. Containing some of the most beautiful residential sections in the midwest, it is an attractive magnet for professional and executive families. Among the major attractions, the Alte Public Schools are certainly to be counted. The high school studied is reputed to be one of the best preparatory schools in the larger metropolitan area; it has a number of tuition-paying students from other communities, as do the junior high and elementary schools.

The resources of money, high educational level of the population, an experienced and well-trained teaching staff, and extremely competent professional leadership could make it the envy of many another district. Yet it is very interesting to discover, as Lou Smith's case study shows, that some teachers complain of the problems of student motivation, of poor articulation between levels of school curriculum, and of inadequate reading and arithmetical abilities by the time students reach the secondary schools. Pupil and parent concerns have resulted in the formation of an alternative high school whose enrollment is limited to approximately forty-five pupils. Thus, one lesson to be learned from the case study of Alte is that the resources educators clamor for do not, in themselves, directly solve all the problems teachers, pupils, and parents perceive.

Substantively, Lou Smith has another point to communicate. That is, the development of a district through its history is not lost in its present form and organization. The constraints

of gradual development are real ones, for a school system can only progress by small increments in the general direction in which the school and community leaders would like to see it go. Through a process which is essentially political, in the best sense of that word, the leaders discover the support that is or is not available for different moves, directions, and goals.

Smith's second major point, however, is both methodological and theoretical in nature. The problem of discovering what makes a school district a district, i.e., a functional social organization with a common sense of direction and professional ethic, is a new focus for a curriculum-oriented case study. Though this focus promises to provide a clear picture of the science, math, and social science programs, how it is to be researched, especially in the time of one semester, is the problem with which Smith struggles. He finds an essential and continuing tension between leadership functions among school personnel and parents and the child-focused teacher-parent relation. Most parents perceive the district science program as the individual teachers who teach their children, and their feelings may be positive or negative. But for some parents, who might be classified as activists or regulars in school affairs, there are more general issues. Some of the faculty and some of the parents have direct access to official decision makers, while others work directly with teachers or principals. Another related methodological problem is that many teachers implicitly take for granted the social structure of the district; they don't explicate it and make it problematic for themselves.

The progress Smith makes methodologically on studying a district qua district is an important indicator of what case study research is capable of and a strong guide for future studies of school curricula.

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THE PERPLEXITIES AS PROLOGUE

In the last decades of the nineteenth century a small group of individuals in the town of Alte[1] gathered together and decided that their community needed a school. Notices were distributed to taxpayers, a town meeting was called. This spring meeting elected the first school board and voted money for a school building. By that September a one-room frame school with forty-eight children and a teacher was in operation. Twenty-five years later, 1907-08, the highschool program began in one room and the upstairs corridors of the new brick grammar school building. The curriculum was algebra, Latin, and English. Today there are a dozen buildings, several hundred teachers and professional personnel, and several thousand pupils, studying literally dozens of "courses."

In 1977, almost a hundred years later, NSF approached the Alte District to do a case study of science education: natural science, social science, and mathematics in grades K-12. Further, NSF wanted policy recommendations. Immediately, the analyst with such an agenda is faced with a series of questions: What is the status of science education today? How is it to be conceptualized; that is, what are the rubrics, the categories, that denote the regularities? Are there differences in the way participants in the system construe these regularities? Is there some better, more ultimate, way they can be conceived? Once these accurate descriptions and categorizations are in hand, how does one explain the transformation of a one-room school house as a district into the contemporary district? Or in more particular form, at the highschool, how does a three-course curriculum, only one of which is "science," evolve into a curriculum of twelve science courses, eleven mathematics courses, and nine social science courses (one of which has five alternative components)? What seems a simple question soon becomes intriguing and a bit ironic; given NSF's broad definition of science education, is natural science explanation the same as social science explanation? Philosophers such as Hempel argue yes; but others, Toulmin and Peters for instance, say no. And then, as we have come to find, social science in Alte High School is mostly history. Is historical explanation the same as natural science or empirical social scientific explanation? Hempel continues to argue yes while Scriven and Dray, among others, say no. To whom do we turn to provide a metatheoretical context on to which we can frame our comments?

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[1]All proper names of places and people have been coded for anomymity. In addition, slight changes in "nonessential" elements have been made to disguise the district and its personnel. It goes without saying that our indebtedness to the Alte District is great. We were permitted free access to classes, personnel and public documents.

If that were not enough of a set of problems, perplexities arise concerning the nature of educational theory. Is it a form of scientific theory or a form of practical theory; that is, where do values fit? Is educational theory mostly one or the other, or is it best conceived as a little of both? Here again, the philosophical experts seem to disagree--O'Connor argues for mostly science ("Do your ethics independently," he argues) and Hirst and Peters (and some others) argue the irrevocable integration in the key concepts--education, curriculum, teaching. On the American Scene, at the level of curriculum, Schwab and Walker argue for educational theory as practical and deliberative. Interestingly, both were trained as natural scientists and have taught science. In my own view, when NSF asks for recommendations it is implicitly asking for a mix of ethical and scientific thought.

A final personal note: in the course of explaining to teachers the nature of the project, as part of the informed consent procedures, the observer found himself offering a personal rationale as part of his involvement in the project. It went like this. "In the past I have been intensely involved in studying classrooms and individual school buildings. I've never tackled a school district. I don't even know how to think about one. To me this is the most exciting intellectual issue in the project." Mostly the teachers responded with wry or amused smiles and grins. The social studies teachers thought the observer was out of his mind (and his depth!) and spent an hour telling him so as they quizzed him about the project. The latter was to the point of a comment a few days later from an administrator friend, "I hear the social studies teachers gave you a bad time the other day." In his own perception the observer felt as though, "I gave as good as I got," and felt pleased with the initial observations of the quality of mind of the social studies faculty.

The major methodological procedure used to attack these problems was participant observation. This is a collection of techniques with a long history in anthropology and sociology and a shorter history in education. Psychology has traditionally phrased some similar research styles as case study inquiry or clinical method and has had an ambivalent and troubled relationship with it over the years. In our use of participant observation we mean essentially that the researcher participates in the ongoing events of the system--classrooms, schools, committees and individual lives. In part, he is stranger and friend. During this, he observes, talks to people, takes notes, collects documents and, most of all, attempts to understand what is happening. While we have tried to capture the methodology in numerous formal accounts, for procedural purposes a brief listing of "Data Sources" is presented in Figure 1. This was

Insert Figure 1 about here

compiled while an early draft of some of the ideas was being prepared on a sunny afternoon in early March. It is only a partial listing for illustrative purposes. It does indicate, early on, the varied settings, people, and events we tried to sample.

1. Administrative interviews: superintendent, principals
2. Extended teacher interviews with several former students and colleagues
3. Beginning observations of classes and teacher interviews
4. Instructional TV--program on Atomic Safety
5. Junior High Assembly--Rural Highlands as an historical, cultural, and commercial region
6. Meeting of sixth grade parents and junior and senior high staff in Math and English
7. Open House at the Alternative High School
8. Meetings of the steering committee for Northcentral visitation
9. Luncheon conversations at several schools
10. Before school coffee klatches at several schools
11. Extended interactions with the research coordinator: shared interviews, shared observations, long substantive and methodological discussions

Figure 1. Illustrative Data Sources: Settings, People and Events (as of 3/16)

From such initial questions--foreshadowed problems, to use Malenowski's term--and from such "observations" of the school and from the cumulating records, we have tried to develop a descriptive and analytic account of science education in the Alte School District. The several sections are organized into these themes:

1. The Perplexities as Prologue
2. The Transformation of the Alte District
3. Conceptualizing a District-Wide Science Education Program
4. Areas of Controversy
5. Conclusion
6. Methodological Appendix
7. References

THE TRANSFORMATION OF THE ALTE DISTRICT

An Overview

While we have not done a formal history of the Alte District, it seems helpful to sketch a few items on a time line over the last hundred years.[2] Such a chronicle will facilitate thinking in several ways, by providing:

1. an account of the lay language of the items considered important by general historians of the Alte community;
2. some points of comparison and contrast to highlight the current program of the district;
3. some of the factual data from which we can build a more analytical and interpretive account of science education; and
4. a framework of the "longer term large changes" into which we can incorporate some of the more recent smaller changes in science education.

In part we are trying to move toward policy issues by explicating "naturalistic/historical" processes of change. Most of the data come from several key sources. A general account of Alte City was written by a local newspaperman and published in 1976 as part of Alte's Centennial and the nation's Bicentennial.[3] Two other accounts are secondary sources in the sense they are histories of the community, but they are also primary sources in that they were written by seventh and eighth-grade pupils and formally published, one in the early 1930s and one in 1976. More will be said of the latter, as a part of the social science program. In addition, high school annuals, curriculum guides, and several reports have been utilized as primary sources. Finally the Alte School News, in existence a dozen and a half years, published by the district for the patrons, has been consulted.

The Community and the Schools

The historical accounts are essentially in everyday lay language. In Figure 2 a one hundred year time line has been produced. The categories of events, strands, if you will, have been

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[2] The ideas for incorporating this approach to the case study were stimulated, in part, by McKinney and Westbury's (1975) essay.

[3] We have coded these documents as well; neither the problems nor the strategies and tactics re anonymity in a mixed historical/contemporaneous account have been spelled out in the literature.

indicated on the ordinate. As the vignette in the prologue indicates, concerned citizens of the community met in 1880, picked a school board, assessed taxes, contracted for a building, hired a teacher, and began an educational program for some four dozen children. The

Insert Figure 2 about here

story is an intriguing one, representing a mix of buildings, personnel, pupils, programs and community. In many ways it parallels the development of much of America.

The community changed from a small town, almost rural, to a major suburban community with a strong commercial tax base and a citizenry of middle to upper social classes. However, the dominant or model group is upper middle class, "executive city" as some writers label it. With the first private subdivisions, zoned in 1910 into one-and-a-half-acre lots, much of what now exists seems to have been determined. This coalescing into a community carries with it the development of a perspective, a point of view, about what is expected in the education of the children of the community. This perspective has jelled into a demand for "academic excellence." In the elementary schools, "excellence" is defined in terms of attitude (development of a desire to learn) as well as achievement (especially in reading and mathematics). The junior high is to provide a transition into the disciplinary studies of the high school. There, a program of knowledge and skills productive of learning, high college board test scores, and entrance to colleges and universities in general and Ivy League schools in particular (for the "best" students) is demanded. In addition, the community had/has the economic resources and the political power to implement its point of view.[4] In effect the community perspective had become a mandate.

Within the last year, the school board hired an outside educational consultant to conduct an intensive public opinion study, "How citizens in Alte view their schools." While the report contains a number of items relevant to our later specific interests, the overall reaction is appropriate here. The question: "On the whole, would you rate the public schools in Alte as excellent, good, fair or poor?" The responses were 68% excellent, 27% good, 2% fair, 0% poor, 3% no opinion (these latter responses came from citizens who had no children in school).. According to reports from the interviewer, he had not surveyed a district with a higher rating of satisfaction with the schools. At a general level, a congruence exists between what the community wants and what the school system does. Positive sentiments are the outcome. It is important to note, however, that a vocal

[4]Consistently, the Alte School District per pupil expenditures are in the highest ten percent of the metropolitan area.

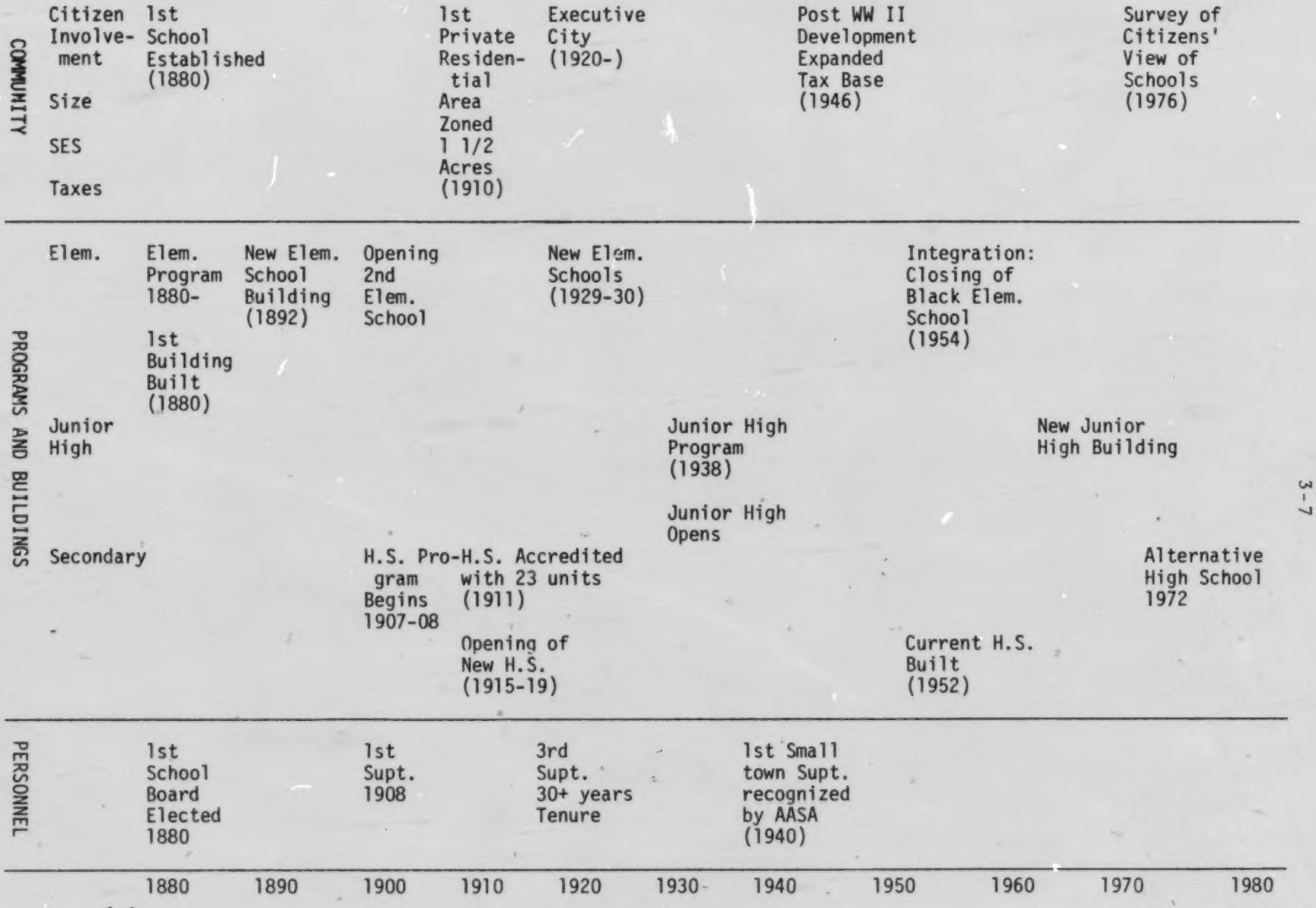

Figure 2. A Partial Chronicle of the Alte School District

minority opinion does exist in the community. One of the issues on the recent television news and in brief accounts in the local newspapers is the concern about the adoption of "untested innovations" and the children being "guinea pigs" in the process.

Such an illustration makes an important but simple point, an oft neglected truism, relevant to NSF's interest in science education. Any kind of change in curriculum and teaching will produce positive and negative reactions in individual parents and citizens. Those reactions, as they aggregate, become direct political forces in school board elections and indirect forces in the day to day workings of the schools. Analyses, scientific, theoretical, or practical, which ignore the latent meaning in a simple illustration such as this do an injustice to the complexity of the reality itself, and to the actors who live and work in the system.

A final word about the social structure of the community seems necessary. Religiously the community contains a mix of Protestants, Catholics, and Jews. Pre-World War II, it had a "Jewish problem," e.g., neighborhoods with restrictive housing covenants. Those covenants and practices are gone now. Racially, the community is almost all White. As yet, there is no "racial problem." A story, going back a hundred years, does exist, i.e., when the original 1880 frame school was no longer large enough, a new brick school was built. The frame building was moved to a new location; it became the "colored school" for a number of years. After World War II, though, the Black community disappeared as property was bought for commercial development. Economically, our earlier account indicated no "social class problems"; the community is basically homogeneous, upper middle class with a strong tax base financially supporting the schools. For this report these conditions are givens, a context for consideration of a particular science education program. For the social analyst and critic of American society who is concerned with broader issues of social conflict, pluralism, equality, and "success" in the American Dream, these conditions could be taken as problematic.[5]

The Alte Schools

During the first twenty-five years at the turn of the century, the school district--that is, the one-room school-- was reasonably stable. In the years around 1910, a series of interrelated events occurred.

1. The population of the town of Alte increased.
2. Parents at the end of the district farthest from the school wanted a school closer to home for their children. A second elementary school was built.

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[5]Once again, the key role of values in a general theory of education seems evident.

3. The old frame building of the first school had been replaced with a larger brick building.
4. The high school program was begun.
5. The first superintendent was hired.

Later, concomitant with the community consolidation in the twenties, thirties, forties, and fifties, the school district's administration enjoyed the long-term tenure of its third superintendent. He led the district--carefully, shrewdly, some say benevolently but autocratically, and with some professional notoriety--for over thirty years. He built the elementary schools, the junior highs, and a new senior high school. The program expanded and became more complex and more specialized. He himself was one of the first nationally recognized small city superintendents. Through most of his three decades he both knew what the community wanted and helped shape concretely those expectations.

For illustrative purposes, the changes in the general school curriculum can be evidenced in the growth of the high school curriculum.[6] Before 1907-08 those youngsters who wanted a secondary education enrolled in one of the nearby City high schools. As the program began for the ninth graders, English, Latin, and algebra were the first subjects. The program grew in size and complexity and through a series of temporary quarters. After World War I, the first high school building was built and staffed by a dozen teachers. The first high school annual indirectly describes the program by listing the subjects taught by the teachers. Currently in 1977 the program includes a dozen courses each in language arts (English, journalism, theatre), social science, science, mathematics, fine arts (art and music), practical arts (industrial, commercial, and homemaking), foreign language (French, Spanish, Latin, and German), and miscellaneous (physical education, driver education, psychology, etc.). Figure 3 presents these in graphic form.

Insert Figure 3 about here

Now, in the late 1970s, the environment is shifting once again. Alte, like many school districts, is faced with declining enrollments. The most deep rooted general concern of all the teachers in Alte, including the science teachers, is this spectre of declining enrollments. When the few non-tenured teachers in the faculty are gone, and the district is highly tenured, what happens to the tenured faculty. What will be the role of excellence and competence, the role of age and seniority? Most certainly one of the hoped-for consequences by the administration, board, and citizenry is toning up the system, self-development by staff in

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[6]Once again, the need for a thorough historical analysis is quite clear.

English Latin Algebra	Accreditation of the high school: 23 units	Normal Training History Economics Science English Music & Art French Manual Training Domestic Science Commercial	Language Arts (English, Journalism, Theatre Arts) Social Sciences Science Mathematics Fine Arts (Art & Music) Practical Arts (Industrial, Commercial, Homemaking) Foreign Languages Miscellaneous
1907/08	1911	1918-1920	1976-1977

Figure 3. The Changing Secondary Curriculum in Alte

overcoming "softness and flabiness," energizing some of the teaching core which has gone stale. Another outcome feared by many of the teachers is the [chance or] occasional negative phone call of a parent to a board member, or the fawning by fellow teachers to administrators or board members. In part, administrators may be faced with hard choices; in part, that's what they are paid to do and expected to do.

In brief, a variety of planned actions are underway as the district tries to cope with these changes. Most of them are outside the scope of this analysis. But the issue becomes a part of every individual's perceptions, thinking, and acting. The implications for an organization such as NSF seem both obvious and obscure. The expansionist excitement, the unlimited opportunities, the predominance of hope of the late fifties and early sixties is gone. If broad scale curriculum development and implementation was difficult then, it will seem like a teaparty compared to the present and immediate future. Risktaking is precarious at best, foolhardy or dangerous at worst in such an environment. Introspection, reflection, seeking an identity, cautious and more carefully and specifically aimed change seems to be the atmosphere in Alte. Aspects of these items will be elaborated upon later at several points.

Initial Implications

Overall, several interesting aspects appear to be generalizable. In looking at such a brief chronicle there seem to have been implicit in this several theoretical elements:

1. Contextually, similar events had been and were going on in small communities all over America; models, legal requirements and procedures were present.
2. Citizens, acting individually and together, were defining goals, designing means, and actualizing those events.
3. In what seems to be an incredible kind of social stability, a hundred years later citizens are still expressing opinions (now with the help of public opinion surveys, as well as face to face comment, criticism, and support) and still acting through a local board of education.
4. The educational system which was established--governing board, curriculum, teacher, pupils, and a specified time and place--is systemic. It contains the major interdependent elements in a simplified microcosm.[7] Those basic elements persist even in the midst of overt change.

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[7]A similar, but more philosophically grounded view is presented by Gowin (1976). He speaks of these elements as "educational commonplaces."

5. In 1907-08 increasing population and a concomitant increase in complexity of the organization (three elementary schools and the beginnings of the high school) seemed to raise problems of coordination and responsibility; the first superintendent was hired, thereby making for further complexity of the organization.

6. Complexity is an intriguing concept. So far, increasing complexity refers to at least these phenomena.

   6.1 Additional numbers of the same units--more elementary buildings, more teachers, more pupils
   6.2 New kinds of units--a high school, later a junior high
   6.3 Increasing specialization of positions--individuals who don't teach but administer and coordinate; principals and the superintendent, special kinds of teachers
   6.4 Increasing hierarchy of governance and control; what originally was: citizenry-board-teacher-pupils becomes: citizenry-board-superintendent-principal-teacher and pupils. Later, assistant superintendent positions and assistant principalships at the high school were created.

7. Finally, as the present social environment of the schools changes--in this case, declining enrollments--major changes begin to occur at all levels and in all parts of the system. Individuals perceive the changes as a "new ball game"; they conceptualize events differently: "a new set of rules," new interpersonal relationships, "teams," are formed.

In short, even a brief historical overview gives an observer a context of stability and change in the community and in the schools.

An Analysis of Recent Change: IPI and the LRC's

As has been indicated, developing an understanding and explanation of the large scale transformation of the district's educational program over one hundred years would require the efforts of an historian. We have made some tenative allusions to the shaping of the community as upper middle class with the correlated expectations for an academic college preparatory program in the schools. For a more detailed analysis of within-school changes, it seems instructive to take an instance or two of recent changes and chart them in more detail. The situations are the correlated development of the elementary school Learning Resource Centers (LRC's) and the modification of the elementary mathematics program through the introduction of IPI math, Individually Prescribed Instruction in mathematics.

The Context, Beliefs, Interactions, Sentiments

As one talks with principals and teachers in the Alte Elementary Schools, the term "individualizing instruction" appears and reappears in discussions, interviews and in classroom action. The core meaning seems to be "What can I do with/to/for each individual pupil to help him/her learn." There is high congruence between espoused theory and theory in use in most classrooms. If individualizing instruction is the intermediate goal, teacher autonomy on how to get there is a major means. Few beginning teachers have entered the system in recent years. Most have gone through a three-tiered hiring process--paper credentials, intensive interviews, and observations of teaching. Teachers were/are hired because they have a point of view and demonstrated skill with the children.

A second belief which appears in the discussions with many of the staff is that of professional responsibility. The core meaning is wanting to be judged for actions which s/he took based upon his/her analysis of an educational problem and situation, and in which s/he made his/her best decision. The clearest accounts of this position came in discussions with teachers as they talked of the reasons they elected to teach in the district. Usually they contrasted Alte with the larger, multi-leveled, bureaucratic systems from which they had come. Usually also they commented about interpersonal contacts in P.T.A. meetings and parent conferences as test cases for accountibility in this kind of professional responsibility. From an administrative perspective this phenomenon is usually voiced as, "'District policy' has been to hire the 'best' teachers and give them freedom to develop their programs."

A third related, and more implicit factor, at least in conversations and interviews, is the "friendly competition" among the elementary schools: that is, within the small group of elementary principals, and, in turn, between the staffs of the elementary schools. The competition seems related to the development of a "building identity" and a favorable reputation among the immediate patrons and across the small district itself. The summary observation notes picked this up in an early discussion:

> As they talked it seemed to come out that different schools had different things going for them(as I'd heard previously). For example--one has a big outdoor education program, second grade and up, overnight camping, etc. Another is trying out some of the new CEMREL math materials in the primary grades, and so forth.

Immediately, upon these notes came the interpretive aside:

> (Obs - All this suggests aspects of the old elementary principals' competition, identity, and place in the sun as a major issue in the dynamics of a district and efforts in curriculum, teaching, parents, etc.)

The identities engage the parents and children and are manifested in such diverse phenomena as spring festivals, flower and garden sales, and picnics. Woe to the principal and teachers who fail to

perceive, to involve themselves, and to support such functions.[8] Within the buildings, the competition and identity issues flow into such diverse avenues as open space ("the big room" where a wall has been torn down), team teaching, reification of self-contained classrooms, elaboration of an outdoor education program, or, for our purposes, curricular and organizational change in the form of IPI and an LRC.

The Story of IPI and LRC's

The story of IPI and the LRC's is really a story of the confluence of several interrelated strands of development. First and foremost, some ten years ago, in one of the elementary schools, the principal and several of his teachers remained dissatisfied with what was being accomplished in mathematics instruction. The district program was a mix of innovative projects--Madison math, University of Illinois math, and SRA; the mathematics curriculum committee was moving toward adoption of the Addison Wesley texts. Their own concern was on problems of "individualizing instruction." As class size in their school was declining, the individual non-achieving pupils were less likely to "get lost" in the crowd. The staff, in coping with this, tried several approaches.

A modified "Joplin plan," shuffling the kids from all the primary grades into ability groups for part of the day, was tried. It foundered in part on the mix of dull third graders and bright first graders at the "same" level of achievement. Later, the teachers moved toward developing individualized teaching materials by cutting up old work books by topic and process, collecting scattered materials from their individual files, and gathering games and manipulative materials. The need arose for some kind of centralized space and storage.

Meanwhile, attempts were underway to develop a central library in the school. Initial steps were to open a room at noon. This raised problems with lunch duty, resources, and staff. "A lousy way to run a library," as one staff member commented. Proposals were made to the superintendent for one of the teachers to take on the task full time (in several schools), for a kindergarten room to be converted, and for parent volunteers to be solicited.

About this time a new assistant superintendent for curriculum was hired.[9] His charge was K-12. He was looking for points of entry into the system. He found this elementary staff congenial and joined forces. He brought knowledge of the activities at the

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[8]A number of stories exist of the politics of the individual schools and the district, but they are beyond our interest here.

[9]Again, our data are limited; the reasoning of the then encumbent superintendent, now gone, is not known.

Pittsburgh R & D Center and the Philadelphia Lab, RBS (Research for Better Schools). One of their major programs was an instructional system in mathematics entitled IPI, Individually Prescribed Instruction. Several teachers and the principal visited the demonstration school in Pennsylvania. They were struck with the similarities between what they saw and what they were trying to do. They argued for giving it a try in their school. The board agreed.

To work well, the IPI system requires something akin to a learning resource center. The Alte Elementary School LRC evolved several steps farther. In time it became a facility close to that in Figure 4. Briefly, we would note the LRC contains: a storage

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Insert Figure 4 about here

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area for the hundreds of work sheets in the IPI program; instructional aides who check materials done by pupils, keep records, and dispense materials prescribed by the teachers; school-wide library resource (5,000-10,000 books in each elementary school library);[10] and aides and volunteers who help out in this part of the center. In visits to the LRC's, it was not uncommon to find a half dozen adults busy with children at any one time. The facility seemed to take on a life of its own; that is, its existence and the presence of creative teachers and district resources provoked a series of alterations, additions, and elaborations. As audio-visual equipment was centralized, new programs in literature, e.g., tapes of stories, were developed. Listening and study carrels were added with tape players and earphones. Possibilities in spelling were seen and the Alte individualized spelling program was developed. Special reading teachers, working with individuals and small groups, found a home and became an active part of the LRC. As several staff members commented:

> Housing is a very limited concept and many LRC's are not functional because they become central locations for materials when they should become central locations for learning activities.

The IPI program is well described elsewhere in multiple books, brochures and research reports emanating from the Pittsburgh Learning Research and Development Center, the Regional Laboratory, Research for Better Schools, Inc. (both funded by the National Institute for Education) and Appleton Century Crofts, Inc., the private publisher of the materials. Consequently, only a few brief remarks will be made here; mostly they are excerpts from several hours spent one morning in the LRC with the IPI program.

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[10] Later we will raise the issue of resources, a key aspect of the Alte School District.

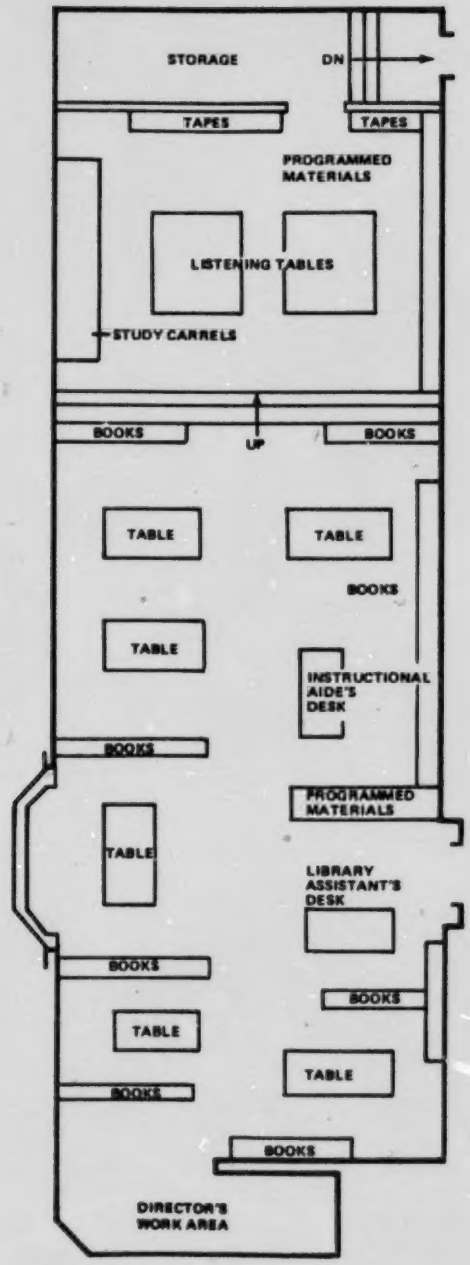

Figure 4. Alte Elementary School LRC.

8:47 Am in the LRC. Fourth, fifth, and sixth grades, in turn, this a.m. Two aides handle kids, grading and dispersing work sheets in IPI. Children in and out--four or five so far. Each has a bright blue folder with materials. The aide, at my request, explains the system roughly:

1. a yellow sheet or Areas (numeration, add/subt, mult, etc.) and Levels A-G (roughly grades 1-6); Figure 5 reproduces this.

Insert Figure 5 about here

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2. Initial placement tests
3. Exercises
4. CET's (Curriculum Embedded Tests)
5. Mastery Tests

The flow of traffic is slow enough that no one stands long in line waiting. Kids bring folders to whichever of two teachers is free. Gals grade while kids wait. Show them if there are errors. Kids correct. With current boy at least two major hints.

(Obs- Through all this I'm reminded of Brueckner's Diagnostic Tests in Arithmetic. The system seems a logical outgrowth of that point of view. Need to look at old NSSE Yearbook from 1934 (?) and the Bond and Brueckner Diagnosis and Treatment of Learning Difficulties. Need to check manuals. Seems like a teaching and organizational system (aides, storage and LRC) building upon that. Need to look at IPI manuals and reference literature.)

I go through Placement Test C. There are two or three pages on each area. It does look like Brueckner writ large.

9:33 The aide asks if I can follow. I take that as an invitation and go over as she corrects a couple of papers.

1. They score and record; she handles mostly exercises; the other aide the tests.
2. Have booklets of answers (keys).
3. Kids must correct and see teachers for help and clearance.
4. If kids ask re their mistake they will indicate--especially re silly mistakes. "Teachers don't mind. We're not supposed to teach the children." (Obs - Apparently they handle the issues in a commonsense, reasonably deferent manner. These two gals seem bright and knowledgeable.) "Feel stupid if you don't answer a child's question."

Name: _____

Grade: _____

AREA	A	B	C	D	E	F	G
Numeration/ Place Value	Part 1						
	Part 2		Part 1				
Addition/ Subtraction	Part 1	Part 1	Part 2				
	Part 2	Part 2	Part 1				
Multiplication			Part 2				
Division							
Fractions					Part 1		
					Part 2		
Money							
Time							
Systems of Measurements							
Geometry							
Applications							

Figure 5. Yellow Sheet representing IPI Scope and Sequence Summary

A formal explication of the more generalized LRC procedures is reproduced as Figure 6.

Insert Figure 6 about here

This figure is used by the staff to explain the general teaching strategy of the LRC, a part of which is the IPI program.

The field notes of the morning continue. They capture more of the flavor of the system and the possible slippage between the ideal and the real.

10:00 The flow continues in and out. I talk some more with the aide.

1. The individuality of kids--attitudes, temperament, "con games" (Can my teacher ok this?)--continues.
2. Most of the grade X[11] kids, as I look at a room-ful of summary sheets, are in Level X materials. A few scattered down and up. One kid tested out of all Level X materials and has done only two booklets all year. To my incredulous response, the aide indicates that the youngster works very slowly, the section she's on is difficult," lots of problems and kids get hung up, teacher would never let her just sit." Finally she agreed it seems strange.
3. Kids are only on IPI three days a week.
4. I haven't seen any great antipathy to the materials. Kids seem to enjoy walking and moving around. Some clowning of kids with each other--swatting and brushing each other with the bright blue folders. Seem to enjoy the aides who are calm, in good spirits, helpful, quick and efficient. Kids lean on the aides' desks, sit on a nearby table, chat while they wait, etc. (Obs - somehow the personality, the approach and the skill of the aides seems very critical.)
5. Kids are in and out of the shelves, and in some instances the file cabinets, for materials.
6. The file cabinets contain, among other things, partial booklets--left over pages for kids who only need a section or two.

Later in the same morning, the notes picked up another strand of data, documents about the program, and initial interpretations by the observer. These, too, are presented verbatim:

[11]Once again, the coding is for anonymity.

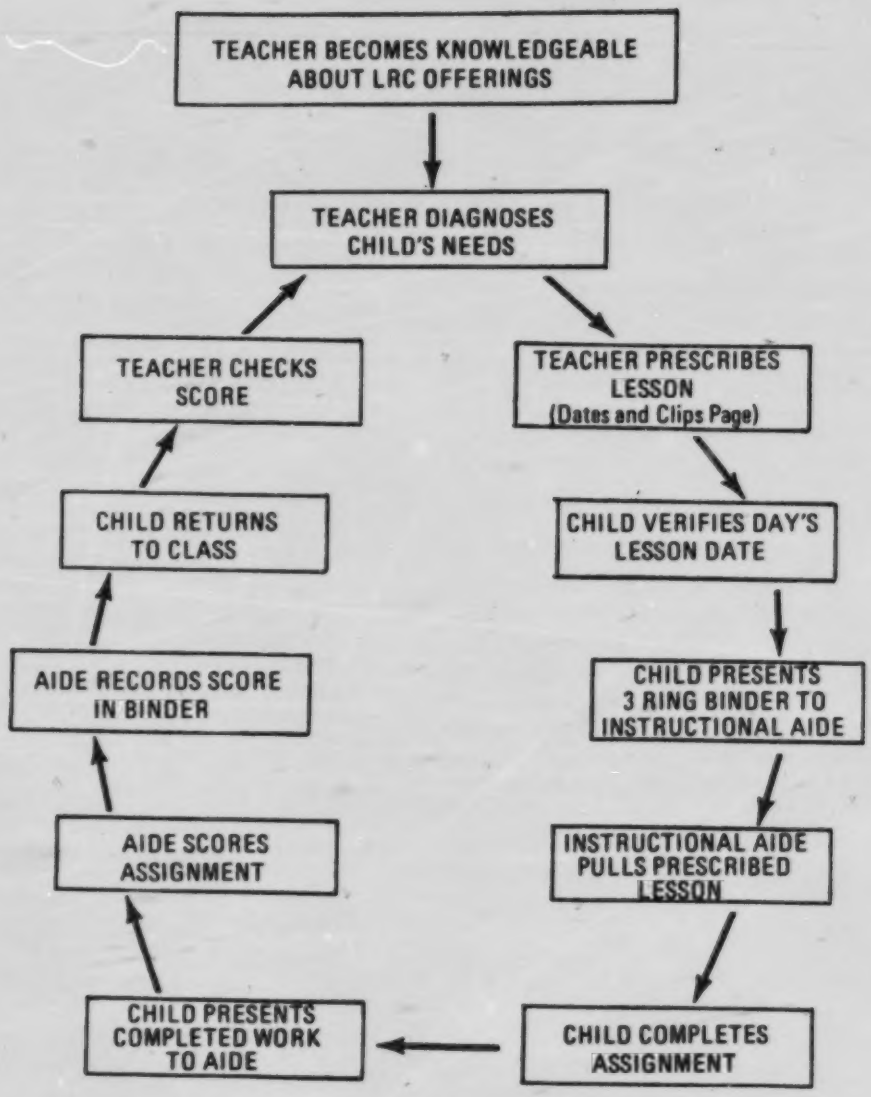
TEACHER BECOMES KNOWLEDGEABLE ABOUT LRC OFFERINGS
TEACHER DIAGNOSES CHILD'S NEEDS
TEACHER PRESCRIBES LESSON (Dates and Clips Page)
CHILD VERIFIES DAY'S LESSON DATE
CHILD PRESENTS 3 RING BINDER TO INSTRUCTIONAL AIDE
INSTRUCTIONAL AIDE PULLS PRESCRIBED LESSON
CHILD COMPLETES ASSIGNMENT
CHILD PRESENTS COMPLETED WORK TO AIDE
AIDE SCORES ASSIGNMENT
AIDE RECORDS SCORE IN BINDER
CHILD RETURNS TO CLASS
TEACHER CHECKS SCORE

Figure 6. Organizational and instructional strategies in using IPI and LRC

11:13 I'm now working my way through

1. IPI Continuum Chart
2. Vol. I Diagnosing and Prescribing for Individualized Instruction
3. Vol. II Managing Individualized Instruction

The IPI Mathematics Continuum is a scope and sequence chart. The aide read the early editions when she first started but not the most recent [third?] revision. She doesn't know whether the kids finishing it should be ready for algebra. The strands seem a hodge-podge of traditional arithmetic skills, common knowledge (money and time), systems of measurements (English and metric), geometry (angles, cylinders and circles), word problems (reasoning ?). On the surface I don't see any "ultimate logic or structure of math" but then I might not recognize it even if it were there.

This review then triggered an even broader set of speculations by the observer.

(Obs - Am struck with the general developmental issue of all kinds of knowledge, much reinforced in the home--cups/pints/quarts/gallons, etc. which one would also get in reading recipes, and other hobby type activities.)

I quiz her (the aide) about homework. No IPI work goes home. It's all done at school. She assumes it's school policy. Any homework would be other activities.

(Obs - Wonder how concerned parents monitor the system and insure kids' success? That would be another latent function of text, homework assignments, and monitoring, helping, encouraging, punishing, controlling kids' behavior. Part of socioeconomic status correlates in conjunction with general ability difference. Contrast with Washington School.[12] Best local evidence on the sixth grade parents' reactions at the meeting on transition to junior high is the P.T.A. meeting at the Washington School. The Alte parents are more knowledgeable, more education oriented, more sophisticated re education [Ph.D.'s, M.D.'s, college education] and channels

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[12] Scattered through this report are references to our earlier study of an urban slum school (Smith and Geoffrey 1968). Perplexities from there have been with us for a decade. New data and images are constantly being compared and contrasted.

for achievement and "getting ahead," more demanding for school performance besides "be there, on time, do work."

I think what I'm reaching for is a set of reasonably simple hypotheses [mechanisms] on the antecedents, nature and conception of school learning with particular emphasis on explaining the high achievement levels of upper middle class kids, e.g., the two grade levels and/or 1+ SD above the mean on test scores.)

11:47 I'm running out of time. Quickly scan IPI books and manuals.

1. No reference to any professional literature in them
2. As though it sprang up new out of only very general tradition
3. (Obs - Even "how to" books, which these are, should have some sources skeptical people can go to.)
4. Books are quite clear re steps, procedures, mechanics
5. Several spots have been red inked (for and by aides?) re flow of materials

And just before leaving, the observer made a final concluding interpretation.

I'm amazed/struck by the seemingly flawless aspect of the system here. The aide has been with the program several years. She has no problem, works very rapidly, etc. At this end, the personnel, the facilities, the storage of materials, the plenitudes (nothing looks like it's even close to being out), the routines are all running smoothly. Need to look at other end.

Over coffee, the observer talked independently with several teachers. The notes contain several diverse but relevant pieces for the analysis.

1. She's pro IPI, relieves the teacher of routine work, time to do more interesting things with the kids.
2. Most of this school are pro, most at school B are anti, others up and down.
   (Obs - There's a funny quality re schools--principals, teachers, relationships. Don't really know as yet.)
3. She says she tends to spend remaining time following along (loosely?) a text with supplemental materials.

> (Obs - I get the feeling of multiple ways to skin the proverbial educational cat. Alte has huge array of resources, experienced teachers, able kids, low teacher-pupil ratios. Groups [schools] develop norms re how things should be done, what is good and bad, important and not, and are able to argue quite tenaciously.)

And, in regard to another teacher conversation:

> She has some reservations. Most of the teachers are supportive of the program. Her reservations include: (1) need group activities;(2) need togetherness versus going in fifty directions; (3) need more problems and practice than booklets provide.
> (Obs - Very complicated mix of values (togetherness) beliefs: ways of organizing the class (grouping) and what it takes to learn certain things.)

The Epilogue

The IPI program remains as one of the most controversial programs in the district. The essence of the epilogue is that the story isn't finished. Several items might be mentioned. The program did not spring into full bloom in the form we have recounted. It was tried for a year or two in the initial school. Presentations were made to the board, discussions were entertained, and the decision was made to implement it in all of Alte's elementary schools. From that point on, the road has been more stormy. In the eyes of one teacher, "It was forced on the rest of the district by the assistant superintendent."

The program has been in considerable contention since then. Some parents have been very dissatisfied. Local test scores in math were reported to be lower. Several years ago an independent assessment of the curriculum was commissioned by the board and carried out by a local firm of evaluation consultants. They reported favorably on the program and recommended that IPI be retained as the core of the mathematics program.

Math teachers at the junior and senior high school in general look with disfavor upon the program. When the board moved recently to have the elementary math program to be half IPI and half teacher developed curriculum, one of the teachers commented, "We've got the battle half won. It'll be totally won when IPI is completely gone."

The LRC's have fared better, in the sense of less conflict. They've developed somewhat differently in each school, but each provides a wealth of resources and activities to supplement the teacher in her classroom.

As an illustration of curriculum change and transformation in Alte, the IPI and LRC stories present several lessons: teacher autonomy and professionalism, administrative influence, competing groups, conflicting points of views, multiple kinds of evidence, and a never-ending process with moments of quasi-stationary equilibria. That this is not atypical of the district can be seen in our current observation, e.g., the beginnings of the CEMREL's new math with its "mini-computers" in the primary grades of one of the Alte Elementary Schools. Our interviews and observations of outdoor education, of which we'll say more later, present another instance. And so on.

To determine how similar or different Alte is from other districts requires other data. Presumably other case studies will illuminate these comparisons and contrasts. Analytically, syntheses of antecedents and consequence in additional cases and from historical and contemporaneous accounts will move toward more general models, paradigms, and theories. That is not our task here.

Organizational Structures for Coping with Curriculum: A Final Observation and Comment

The discussion of the history of the district and the items of recent change provide one perspective on science education in the Alte Schools. Another point of view arises in considering organizational structures for "coping with curriculum." The verb "cope" is deliberately chosen as a label for a broad set of issues (e.g., develop change, implement, integrate) involving "struggling or contending with some success." Alte has these mechanisms in place.

1. The school board reserves one meeting per month for discussion and review of curriculum. Areas are taken in rotation and/or as need arises.

2. Each major elementary curriculum area (language arts, math, science and social studies) is represented by a committee of teachers, chaired by an elementary principal. Chairmanships are rotated and allocated by choice, interest, and competence.

3. Each area of the grade 7-12 program is headed by a curriculum co-ordinator, often, but not always the chairman of the relevant high school department. The co-ordinators teach a full load during the year and work the equivalent of an extra month in the summer and weekends.

4. The curriculum chairman and co-ordinators meet once a month.

5. Over the years, resources have been available for summer curriculum work by teams of teachers and administrators.

6. Each principal is responsible for the program in his/her building.

7. Each teacher is responsible for the program in his/her classroom.

What the structures were in the past is not clear. Each superintendent seems to have developed his own arrangements. District files of curriculum committee reports go back only to the late 1950s. Whether this is a function of no earlier curriculum work or lack of historical data is not clear. Other records and interviews indicate that in the recent past there have been assistant superintendents for curriculum and these individuals played influential but controversial roles in the district.

A further aspect of the system's organizational structure is the rotational review of principals. One or two are "up" each year which means the district review cycles everyone every four or five years. This has both a formative and summative aspect.[13] In regard to the former, discussions are held, mutual agreements are reached on self-improvement goals--for instance, science or social studies curriculum improvement in the school. Procedural steps are laid out in terms of introduction of ideas and materials, individualized work with specific teachers, and so forth. Early on in the course of one such discussion the observer made a brief interpretive aside:

> (Obs - Again a possible point of departure for analysis. How does a school bootstrap itself?)

With the accumulation of further data, such formative evaluation procedures seem to elaborate aspects of the district's coping with curriculum.

Several important generalizations seem to stand out from this analysis. First and perhaps foremost is the tension or dilemma between the bureaucratic/organizational tendencies and the individual/professional tendencies. On the one hand the organization is continually striving for rationality--agreed upon goals and priorities, clarity of procedures and organizational mechanisms, responsible supervision. That is, there are committees with domains of activity

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[13] We obtained little data on the summative evaluation aspects, an issue beyond the scope of this investigation. Suffice it to say there has been considerable turnover of principals in the district over the last dozen years.

and chairmen responsible for their functioning. On the other hand, as we will present in detail later, there are highly trained, competent professionals in schools and classrooms who are selected, hired, and expected to know what to do in their own domains, to choose and decide intelligently and responsibly, and who exercise and enjoy their autonomy. As we have indicated, the dilemma is really a "tri-lemma" in that political forces operating through citizen accolades and complaints to the board are part and parcel of the overall coping process.

If all this be true, and our data and analysis would so argue, then an agency such as NSF, or a national curriculum project, or a university department or school of education engaged in teacher education is faced with a kind of reality not usually described in the educational change and innovation literature. The local district arrangements in curriculum and teaching--science education, if you like--are not happenstance, not chance, nor accidents, but the resolutions of individual choices, contending points of view, and differential power. NSF (and the other outside groups) becomes a fourth category of contestants with its own resources and rewards, its own point of view with all the internal consistencies and inconsistencies, its own skill in persuasion and influence. The social processes continue.

CONCEPTUALIZING A DISTRICT WIDE SCIENCE CURRICULUM

Introduction

Initially, and tentatively, we can define curriculum as "...a programme or course of activities which is explicitly organized as the means whereby pupils may obtain the desired objective..." (Hirst and Peters 1970, p. 60). Even a superficial unpacking of such a definition indicates the theoretical complexities and the empirical quagmire in the conception. The essential difficulties lie in the constraints provoked by intentions and plans of some agent implied in the phrase "explicitly organized" and in the constraints provoked by the pupil learning outcomes implied in "desired objective." In effect, curriculum, by definition contains a three step proposition:

intentions ⟶ activities ⟶ attaining desired outcome

Further complications arise, as our preceding analysis of the Transformation of the Alte School District suggested, for there are several clusters of actors with intentions--board, administration, teachers, children, and parents. In general, in Alte, the intentions of these groups are congruent.

There are a number of ways one might cut into the phenomenon of curriculum. As one teacher said, "Science education may be defined by NSF as math, science, and social studies, but no one in the Alte Schools sees it that way." In Alte High School, for instance, the administration, the teachers, and the students see three separate departments--math, science, and history. That separation exists. The departments meet as departments, plan curriculum, decide (in part) who teaches what courses, what new offerings might be tried and so on. The courses tend not to be interdependent across disciplines. This is what we have come to speak of as "formal curriculum." Beyond an analysis into these domains of math, science, and social studies, the overall program seems amenable to an analysis in terms of dimensions, aspects that cut through the program. The most significant of these will be sketched out in some detail.

Formal curriculum reflects only a part of what is happening in the Alte Schools in science education. We kept "bumping into" a number of "special events" which were occurring during the semester, which were referred to or which had left products from the past. They consumed considerable amounts of time and energy of staff and students. They seemed relevant to important educational goals. They tended to cut across disciplines. This we have called "informal curriculum: degree of enrichment." The two major instances which will be analyzed are a community history project carried out by the junior high pupils and the outdoor education program implemented at all levels of the district.

Finally, a category of events, almost a latent curriculum in itself, is what we have called "curriculum or what is taught: vignettes of teaching." In effect the rubrics of formal and informal curriculum miss a major element of the Alte District's program, the "individual teacher with his idiosyncratic style." Alte prides itself on its "good" or "strong" teachers. "Living legends" might be an even more apt title. To miss this is to miss what many would see as the core element of science education in the district, or education more generally in the district.

In addition, the fact that there are separate elementary, junior, and senior high schools creates some obvious but nonetheless important distinctions. The buildings are geographically separate. By law, the elementary and secondary training programs in which the teachers have been educated are different. The organizational arrangements, departmentalization vs. self contained classes, vs. open space and some teaming, are different. Such environmental events lead, quite naturally, to each building (and each department in the high school) developing its own social system--activities, pattern of interactions, beliefs, sentiments, points of view and norms. To a degree, there is differentiation within the overall district.

Formal Curriculum: Science, Math, Social Studies

The unit of analysis of the curriculum in the day to day functioning of pupils, teachers, administrators, and accrediting agencies is "the course." The day of a pupil and the career of a pupil can be tracked through the courses s/he takes. Similarly, teacher work loads, daily schedules, and responsibilities are tied intimately with "the courses" s/he teaches. Consequently, we present, initially, the patterns of courses offered in math, science, and social studies. Then we will look to regularities and aspects of the course structure by which we can talk of differences across districts. Later we will raise complications arising from an analysis of science education based solely on course labels and descriptions.

Elementary School

In the elementary school, particularly in the primary grades, everyone we talked to accented the fact that reading was the subject taught and learned. Time, effort, and much of the extra resources (reading teachers, libraries, and materials centers) focused on reading. Parent expectations, elementary teachers' backgrounds and credentials, pupil activities are congruent. Administrators commented softly--"The reading problem is licked. There aren't a half dozen children in the eighth grade in the junior high who read at less than sixth grade level."

With that as backdrop, the most important fact about science, math, and social studies in the elementary schools is that the program is "half discretionary" with the individual teacher. In

science the ESS experiments are half the program and a variety of activities make up the other half. In math, the program is half IPI. Social studies is the most varied and has been changing within the last few years. Previously, a list of concepts, ordered by grade level, made up half the program. Recently, the Databank program has been selected as the major curriculum vehicle. Considerable variability exists across schools. Figure 7 presents the range of activities.

Insert Figure 7 about here

In the last few years, various committees and subcommittees of teachers have been working toward a perspective on social studies curriculum. In one of these reports, a committee of teachers representing each of the elementary schools in the district made a series of recommendations. In their prefatory remarks they stated

> The members of the Social Studies Committee agree that the following components and teaching strategies listed here are desirable in a social studies program.

In Figure 8, we present the items from that report. As we read it the content is a mix of knowledge, intellectual skills, value learning and social development. Social studies is seen as a vehicle

Insert Figure 8 about here

for more general development of the classroom as a unit into a cooperative working group. Further, in the report, each of the curriculum possibilities listed in Figure 7 was cross referenced by number and letter as the components and teaching strategies were involved.

In a later report, authored by an administrator/chairman, the Databank system is described (along with several other curricula) in some detail.

> At each level the Holt Databank System is made up of three basic components.
>
> A textbook focuses the problem for study with data which include a full range of visuals: museum reproductions, cartoons, maps, line drawings, and paintings.
>
> The information storage-retrieval unit, the databank, houses a complex media mix of both print and non print materials (called a Data box at K-2 levels). Filmstrips, data cards, LP recordings, data foldouts, data packs, games, simulations, and data masters are included.

Science	ESS (50% of program) Science Projects Sixth Grade Camp Texts Other Experiences
Social Science	Holt Databank (50% of program) MACOS Allyn and Bacon: Concepts and Inquiry Laidlaw Social Science DUSO: Developing Understanding of Self and Others Human Development Program Other Experiences
Mathematics	IPI (50% of program) CSMP Textbooks Other Experiences

Figure 7. Elementary Program (1977): Science, Math, and Social Studies

ESSENTIAL COMPONENTS: ELEMENTS THAT SHOULD BE PRESENT IN ALL SOCIAL STUDIES PROGRAMS.

1. Concept-oriented rather than fact memorization.
2. Multi-disciplinary, multi-media approach.
3. Geographic concepts and skills included at all levels.
4. Research and data processing skills included at all levels.
5. Development of critical thinking included at all levels.
6. Value identification and clarification (personal and social).
7. Includes learning how to live and operate as an individual and with a group.
8. Content provides opportunities for the application of knowledge, skills, values.

TEACHING STRATEGIES.

A. Social Studies should often be the unifying theme for class activities.
B. Emphasis should be on inquiry, discovery, or inductive procedures rather than expository methods.
C. There should be an element of novelty or vividness.
D. In-depth studies rather than survey studies are preferable.
E. Varied activities and resources should be used.
F. The emphasis should be on group activities with some provision for individual interests.
G. Sometimes goals established through teacher-pupil planning are preferable to teacher selected goals.

Figure 8. Social Studies Principles: Curriculum Committee Perspective

> A teacher's guide explains how the entire Holt Databank System works, provides background material, gives unit-by-unit objectives, and provides day-by-day lesson plans.
>
> The textbooks differ from the textbooks with which most teachers are familiar. They do not function as "close-ended" terminal resources--used solely for their own sake. Instead, they are created to function cooperatively within the Databank System.

Finally, the program in each of the elementary schools is described. The within school variations (from grade level to grade level) and the between school variations suggest the complexity of Alte's social studies program. In the committee chairman's words:

> As can be seen by comparison of the Social Studies Committee's Chart and School A's Chart, that school is using throughout, one of the recommended programs at every grade level [Allyn and Bacon: Kgn, 1; Holt: 2, 3, 4, 6; MACOS; 5]. There appears to be no problem in organization or sequencing.

And

> School B uses four sets of materials. Kindergarteners start with Holt Databank. First graders use the Laidlaw social science program. Allyn and Bacon is used in 2nd, and 3rd grades. Fourth grade is a return to Databank, MACOS is used in the 5th grade, and Databank again reappears in the 6th grade.
>
> While the approach is eclectic, the topics which appear in the various programs are similar to what would occur as the child proceeded through school were a single program being used K-6.

The later report comments on the earlier committee's work:

> At no point in their deliberations did the members of the Elementary Social Studies Committee attend to the concept of statistical data as having relevance in determining what the Alte District's social studies curriculum should be.
>
> The question of how students score on standardized tests cannot, however, be ignored, and the following pages contain information on that count.

There follow a half dozen pages of data from the Stanford Achievement Test. One statistic summarizes the results--the median of pupil scores is in the interval between the 81st and 85th percentile on national norms.

Among the report's conclusions, two bear upon the issues of curriculum.

> Elementary social studies continues to be an area in which we find the least agreement on what we should be doing and the most difficulty in fully implementing.
>
> In general, however, the record of what is being done is dramatically improved over last year's assessment. Then, recommended programs could be found in about one-third of the classrooms in the district. Now, at least one of the recommended programs can be found in three out of every four classrooms. Of course, how well they are being used is a judgment the principal must make. And it cannot be denied that some teachers may be doing an excellent job with other than the recommended programs. It would seem, however, that almost every teacher needs a good set of materials from which to start social studies instruction and it also seems that she should feel free to take off from these materials whenever appropriate.

Careful reading of those paragraphs suggests a number of potent but implicit aspects of curriculum in Alte.

The formal curriculum at the elementary school illustrates vividly one of the most central problems in a theory of education as a theory of action--dilemmas, trade offs, and decisions. In this instance, one might draw extreme cases of a prescribed curriculum for all schools and classes in science, math, and social science on the one hand, and a curriculum totally left to each individual teacher on the other hand.[14] In between steps on such a continuum might be the introduction of some commonality within each individual building, which does occur presently in Alte. Another variation between the extremes is to provide a prescription, as is also now in place in Alte, that half of the math time is IPI and half the science time is ESS.

The logic of the alternatives seems to be an accent on motivation, creativity, and interest on the one hand; and orderly, organized, and sequenced teaching and learning on the other hand. At its best, one is back with the former to the "project" and "activity" curriculums of Kilpatrick and perhaps Bruner. With the latter, at its best, one is back to Herbert and perhaps more recently to Ausubel. Complex aptitude x treatment interactions exist at the teacher level: that is, who can do what with each orientation.

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[14] An even more extreme possibility would be to have the curriculum determined by the children. See Anatomy of Educational Innovation (Smith and Keith 1971) for an account of attempts in this direction.

(Similarly, one assumes broad pupil aptitude X treatment interactions at the pupil level.) The complications that exist with smaller elements in the program (e.g., having a library program or involving the children in special events) and with independent parental concerns and initiatives make the experimental testing of such ideas extremely difficult.[15]

To presage one of our later arguments, and a major position in this monograph, the resolution of curriculum and teaching issues is a "complex valuational/theoretical/empirical judgment." These judgments are determined by individuals and groups in contention. Similarly, the mechanisms, the means, the structures, whether they be textbooks, particular kinds of projects, modes of presentation and interaction, are also in contention. The fabric of debate and influence is complicated by ideas, skills, personalities, and reputations of individual teachers, by precedent, by group norms of departments, faculties, P.T.A. bodies, and so forth. Even principals, superintendents, and board members (individually and collectively) seem to have a say.

A market place metaphor fits as one small part of this total process. Teams of "experts" of what ever kind--disciplinary, pedagogical, psychological, organizational, working in National Labs or R & D Centers, or on national or regional curriculum task forces, or in commercial publishing companies, or individually writing texts or units of material-- produce, make available, present their "wares" to the contending groups for their consideration, purchase, and adoption. To see one's carefully crafted creations (MACOS, DUSO, Databank) as "just another set of ideas or materials" may be a blow to one's ego, but it may also be a reality.[16]

Junior High School

Alte Junior High School presents a strong identity as a transition point in the educational lives of its pupils. The obvious physical changes in the youngsters are evident as one walks through the halls. The teachers are different--a minority are former elementary teachers with a "whole child perspective" and a majority are discipline/subject matter-oriented teachers. While a few have "come down" from the high school and a few would like to "go up" to the high school, most are focused (a few aggressively so) on the special problems and possibilities in this transition period. The school organizational structure is a mix of teams and disciplines. Each grade level has two teams composed of four teachers, one each in math, science, social studies, and English,

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[15] Some of these problems in research on "effective teaching" are posed in detail in Smith (1977).

[16] The degree to which Alte's reality is a national reality is another question.

and approximately eighty students. Classes average about twenty children. Teachers teach four fifty-five minute periods and have varied other responsibilities for the remainder of the day. Most have just one or two different preparations, e.g., three sections of eighth-grade math and one of algebra. Except for math, there is no ability grouping. Outside the scope of this investigation are the programs in English, foreign language, P.E., music, art, industrial and domestic arts.

Figure 9 orders the science education offerings. In the seventh grade, life science is taught; and in the eighth grade, physical science is the curriculum. At each level the courses are a mix of texts and laboratory experiments. Social science is essentially a

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Insert Figure 9 about here

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two-year history course labeled American studies. The seventh grade pursues a broadly based American culture up to the Civil War; the eighth grade moves from Reconstruction to the present. In science and social studies the children are grouped heterogeneously (in most instances within the teams of eighty pupils). Math provides the first elements of choice among the core subjects. In the seventh grade the groups split into regular math and pre-algebra. In the eighth grade, regular math and algebra are taught.

Alte Senior High School

Alte Senior High School's Curriculum Guide looks like the catalogue of a small college. Earlier, we reported the overall array of courses. In Figures 10, 11, and 12 the curriculum of math, science, and social studies is presented.

Insert Figures 10, 11, 12 about here

Several general comments are in order. In "science education," Alte requires for graduation one unit in math, two units in science, and three units in social science. The curriculum guide has a paragraph of advice regarding course planning and college admission, a statement on "early completion of high school," the "credit/no credit option," the possibilities of an "independent study contract" and "Graduation with Honors," The latter is split into "High Honors" and "Honors." No mention is made of the Alternative High School.

Both math and science seem to break into two levels. One sequence is for students who will pursue science and professional/technical studies (engineering, medicine, architecture) in college

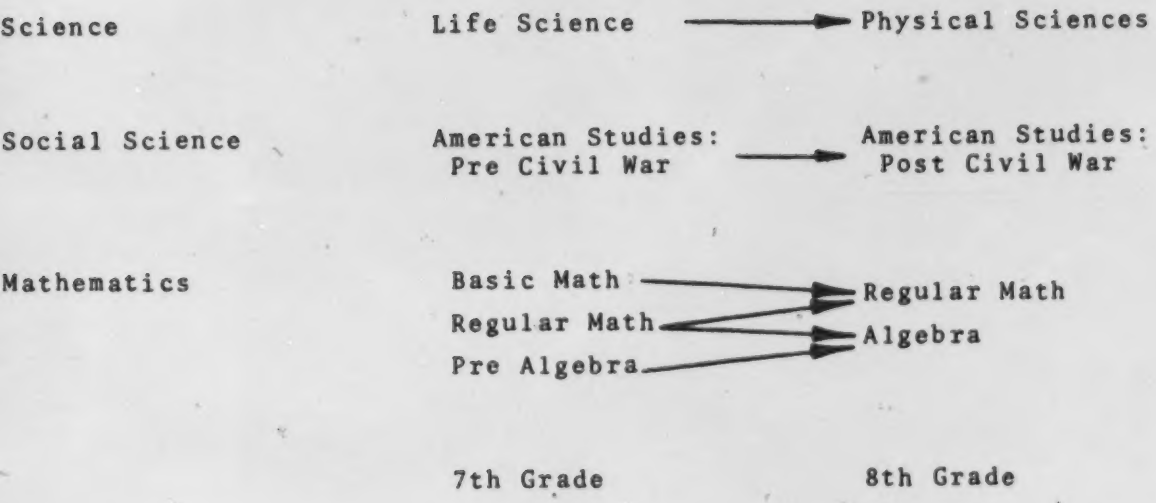

Figure 9. Junior High Program: Science, Math, Social Studies

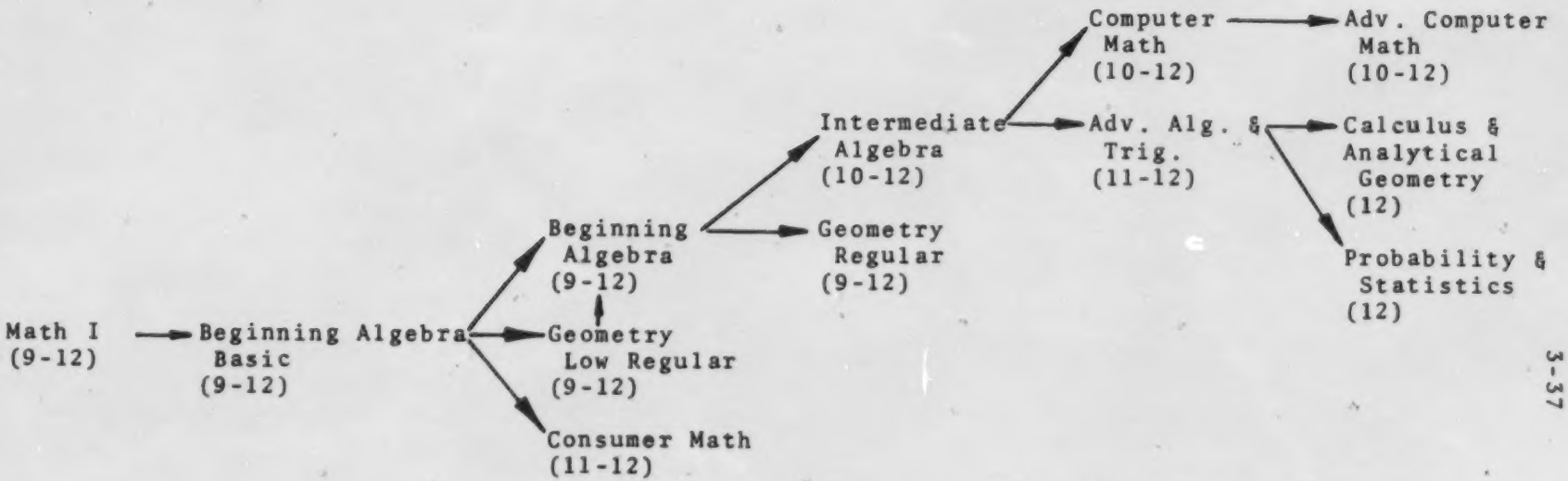

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Figure 10. Alte High School Mathematics Curriculum

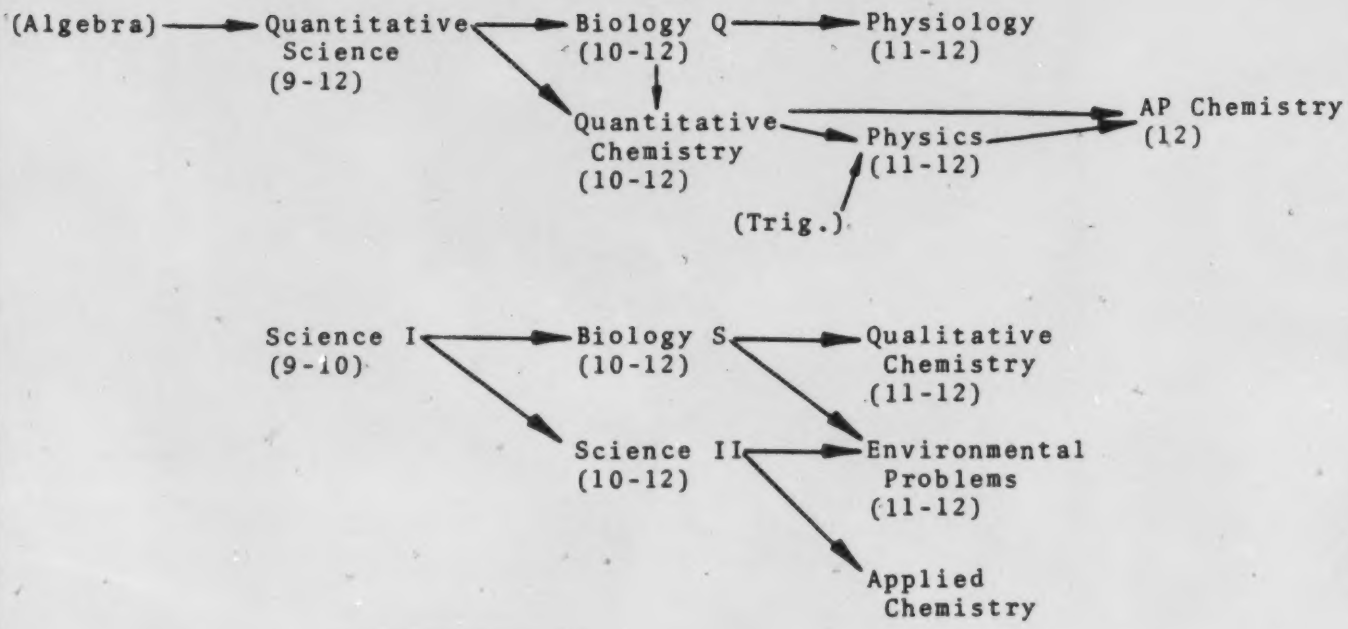

Figure 11. Alte High School Science Curriculum

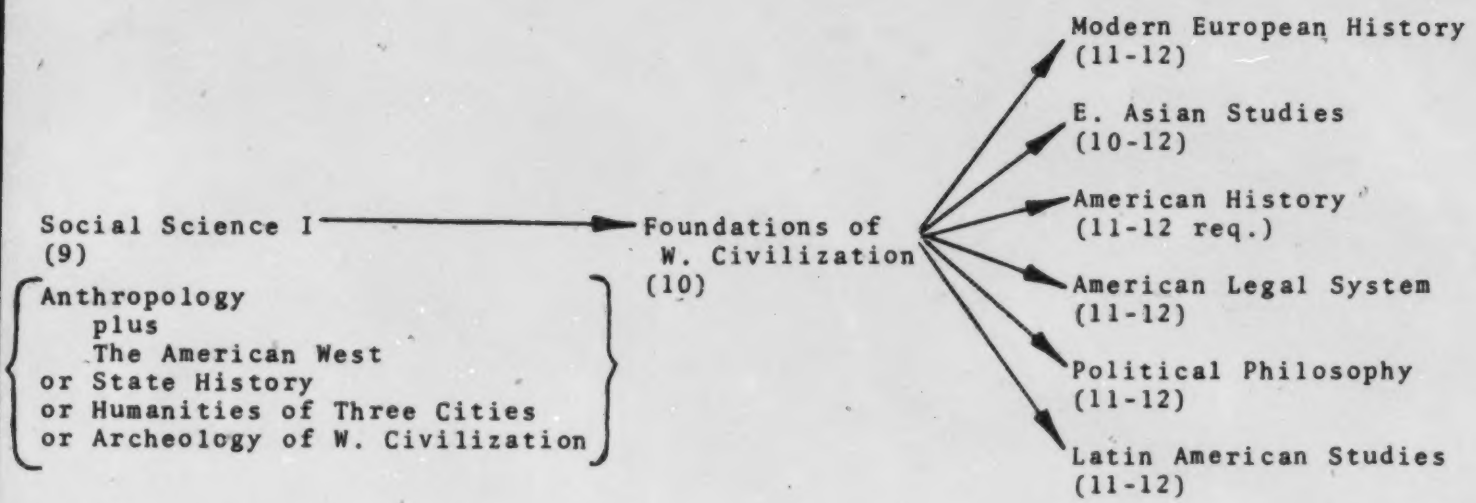

Figure 12. Alte High School Social Science Curriculum

and professional and graduate schools. The other sequence is for non college-bound students. It is possible to switch back and forth. Many college bound students opt out of the more advanced courses. The social science department is heavily history. Its classes are more heterogeneously organized and with fewer prerequisites.

The most important cross-departmental relationship occurs in ninth grade quantitative science, which requires algebra as a prerequisite (or concurrent registration). Physics requires trigonometry which, in turn, has its own prerequisite in geometry and intermediate algebra. As indicated in the discussion of the Alte Junior High curriculum, students have the option of taking algebra in the eighth grade. This tends to begin tracking those youngsters who will ultimately do the most advanced work in science and math.

Dimensions of Formal Curriculum

Early on, the general foreshadowed problem of how one "talks about science education in a school district" began to fracture into smaller problems. One of these was the issue of dimensions or foci which could be used to compare school districts. In the observer's eyes, one of the prototypes became: "if one had fifty school districts and one wanted to compare and contrast them on their science education programs, what categories, dimensions, or foci would s/he select to do this?" In the analysis of the Alte data, a half dozen seemed critical.

Excellence as a Goal

One can not be around the Alte District very long without running into comments about "academic excellence." As a value, purpose, goal, objective it provides a perspective on the entire system, yet, at the same time, it harbors some interesting implications. It doesn't sound like, carry the usual connotations of, the language of behavioral objectives that the educational psychologists and learning theorists are fond of citing. Nor does it convey the flavor of the MBO, management by objectives, school of thought in educational administration. Rather it seems a mix, a corruption perhaps, of a humanistic stance of "knowledge for its own sake" and "learning as a social mechanism."

Excellence is perhaps most closely defined in science education as increasing specialization of knowledge, a phenomenon we'll attend to in more detail shortly. In effect, the more excellent you are--as teacher or pupil--the more you know about some phenomenon--advanced chemistry, history, history of the British Empire, advanced algebra or calculus. The knowledge is increasingly specialized and technical. It is open ended, a vision of unlimited horizons if you like, in that there is always more physics, more information about Western civilization and more advanced math than anyone can absorb in the first sixteen to eighteen years of one's life.

This quest is tied into a competitive system: How is pupil X doing vis-a-vis pupil Y? Places in good colleges are limited. Admission is by grades and college board scores. These instruments are norm referenced; that is, the derived scores are usually, if not always, a number indicating how you compare with someone else, a standardization group. The children of Alte take frequent tests--and do "well" on them. Anthropologists speak of finding the "apt illustrations"--data supporting and illustrating the general point one wants to make. As the initial draft of this report was being written, the observer received a copy of the Alte Staff Bulletin prepared in the superintendent's office. The two lead articles from late May are presented as Figure 13. The statements complement each other very well.

Insert Figure 13 about here

Grades and teacher recommendations begin to have real impact in the seventh grade--who takes pre algebra. The grades are based on quizzes, tests, papers, and lab reports which are given frequently and which are based on assignments, reading, and lab exercises. Most are recorded--"Does this one count?"--and become part of the teacher's armentarium when youngsters want to know what their grades are or parents complain that they think Johnny or Suzie should be doing better.

Such competition puts a premium on those who have "natural" talent and ability. And Alte has many youngsters with very good minds, many of whom are in evidence from the beginnings of the primary grades. The competition also generates considerable pressure for achievement. Some of the more interesting aspects of this appear in the continuing controversy around the Alternative High School which we examine in more detail later. The issue here is that some of the staff see some of the students opting out. "They can't take the pressure." Others see the implications of the alternative life style as a criticism of the core value of the system, academic excellence, and of the complex of related activities, mechanisms, and procedures which enhance that value.

Finally, one might mention the long involved faculty discussions, report after report of summer curriculum committees, the development of multiple alternative courses, e.g., Science I as well as quantitative science, basic algebra as well as regular algebra, and so forth as the school district wrestled with the problem over the years. These courses, in turn, play back into the faculty social structure--who teaches them? What are the implications for prestige in the department, in the school, and in the district generally?

LTE'S EADING ESULTS

As we read in the newspapers about the reading difficulties found in the entering college freshman f in school age children, we may wonder bout Alte's test results.

The following are the reading results from the January, 1977 Stanford chievement testing:

	Qtl. 1	Median	Qtl. 3
rade 1	1.7	2.2	2.8
rade 2	3.3	4.1	4.9
rade 3	4.6	5.7	7.4
rade 4	5.7	7.3	8.9
rade 5	7.0	8.7	10.4
rade 6	7.9	9.8	10.6*
rade 7	9.2	11.0	12.6*

*Top of Test

In first grade an average student ould be reading at 1.5 compared to the ational norms. Our average student was even months ahead of the national average.

SUMMER READING PROGRAM

Attached to this issue is our announcement plugging the Metropolitan Library's Summer Reading Program. In a day or two elementary teachers will receive one for every student K-6.

Please urge pupils to participate and to take the sheet home to get parent participation and encouragement.

We have made a special arrangement (Alte is the only District doing this) to start our kids off with their first Official Metropolitan Library Record Card for this summer program. We will have 500 Record Cards, and will get them to each school within the week. To make sure it's impressive, tell your pupils they must personally ask for one from your Reading Teacher or School Librarian if they wish one.

Get them to read this summer--and make the job easier for that poor tired-looking teacher next year. It may be you!

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Figure 13. Aspects of Excellence

Degree of Advanced Specialization

This dimension of curriculum refers to the depth, level of difficulty or the degree or amount of advanced specialization possible in the curriculum. At one time a high school which offered four years of high school science--general science, biology, chemistry, and physics or several years of math--algebra, geometry, trigonometry-- had programs of depth or high levels of difficulty (Lee 1928). At Alte High School, as the previous figures indicate, students have options including second year biology (physiology) and advanced placement chemistry, and, in the recent past, A.P. physics. In math, calculus is regularly offered; probability and statistics "is still on the books" but has not been offered in several years. In history, the program branches into area studies, contemporary issues, and political philosophy, each of which can be taken in the junior or senior year.

At the district level the concept of knowledge implied in "degree of advanced specialization" doesn't seem to fit the usual rubrics of a Bloom's Taxonomy. A history teacher who "takes on" the youngsters in hard debate wants his/her students to "stand up and argue him/her (the teacher) down"; that is, to be assertive, critical, knowledgeable about ideas, events, and their interconnections (from the Magna Carta to contemporary student revolt). Similarly, the math teacher who entertains a debate among 1) the advanced algebra problem in the text, 2) the students' problem with the problem, 3) the instructor's view of the text problem and the students' problem, 4) his/her own view of the problem, and finally, 5) the text author's implicit possible views of the problem is "presenting," "struggling with," "illustrating" a very complex view of mathematical knowledge. Finally, the biology instructor who is briefly talking to the kids about some preliminary aspect of meiosis and mitosis and involving them in an extended exercise in chromosome and genetic alterations in cell division while demanding that their thinking and ideas get organized into formal laboratory reports and who, at the same time, is having them observing and recording the final days of various specimens in multiple concentrations of DDT, is stressing a further kind of specialized and technical knowledge.[17]

At a simple level, rating or category scales could be developed to measure the degree of advanced specialization. For instance, in science a district with a high school offering general science and perhaps biology seems different from one offering four years of science, and this, in turn, seems significantly different from one offering two years of biology, chemistry, and physics. As our vignettes of teaching will indicate, the relation of these simple catalogue assessments to the intellectual realities of the classroom becomes, in itself, a major problem. Such measures then could

[17]These illustrations will be presented in greater detail later.

be related to a variety of antecedents (size of school, socio-economic status of the community, training of the staff) and a number of consequences (type of college selected, success in college, advanced placement credits, career choices, etc.). And perhaps most fundamentally to the local district's purposes and goals in the education of their children.

A final comment seems in order regarding the degree of advanced specialization. It seems intimately related to the concept of excellence as a goal and to a major kind of teacher frustration--which will be raised in later discussion of teaching. Teachers in Alte who have taken advanced work in their disciplines, MA, MA+, or Ph.D., frequently are caught in a different conflict. The more able they are, the better trained they are, the more they want to express themselves creatively, the more driven they are to settings--advanced placement courses at Alte, evening and summer college and university appointments where they have contact with more advanced (in age and experience) students. Further, they are drawn to laboratories and sabbaticals where they can do their own research and writing. One of the observer's "surprises" was the number of poignant conversations among individuals he had not known before, in which the depth of concern, the frustration, the inevitable and unremitting conflict posed by these elements was raised.

Breadth of Curriculum

Breadth of curriculum refers to its scope or variety of courses. At its most primitive level, it can be seen in the initial three offerings when Alte High School began--Latin, English, and algebra. By 1911 there were twenty-three units offered. Today, Alte High School is referred to by some of its staff as "Alte University" reflecting the breadth and scope of its offerings (as well as the degree of advanced specialization). In the 1976-77 Curriculum Guide, eighty-one units of credit are offered. A student taking five units per year would require a decade and a half to take the whole high school program. As has been indicated, some dozen courses are available in each of the three areas of science education.

"Breadth of curriculum" has its own problems as a scale, for it conceals or at least implies a fundamental conception of a domain of knowledge. This is seen most clearly, perhaps, in social studies. Consider two definitions--conceptions--of social studies.

#1: social studies as history
#2: social studies as empirical and historical social science

In terms of the first conception, Alte has a high degree of breadth of curriculum--American civilization (past and present), Western civilization, Asian studies, Latin American studies. For some students, the American West, state history and the humanities of three cities--Athens, Florence, and New York--is part of the curriculum. The student who concentrates in social science comes away with a breadth of knowledge (as well as depth) about the history of mankind, a far cry from a little civics, a little American history and a little European history.

By the same token, if definition #2 is taken, the youngster has little conception of laboratory psychology,[18] quantitative sociology, and economics or contemporary political science. Anthropology and some archeology are part of Social Science I and generally fit an historical perspective.

This is not to argue either conception as "better or poorer," nor to examine the tradeoffs, nor even to look to the antecedents (e.g., "We're a small school and can't do everything," versus hiring policies in the last decade). Rather, it is to suggest that breadth of curriculum seems an important dimension of a school, that measuring breadth is not as simple as one might first suppose, and that underlying such a dimension are important conceptual and definitional positions.

Degree of Interrelatedness/Connectedness/Integration[19]

This dimension is really several dimensions. Teasing them apart has been a difficult problem. Listing them suggests the complexities:

1. articulation--connectedness from elementary to junior to senior high,
2. within disciplinary/departmental connectedness, and
3. cross disciplinary departmental connectedness.

Each of these represents a story in itself.

The degree of articulation is a "2 X 3" problem--elementary to junior high and junior to senior high school on the one hand, and the three curricula on the other. Conceptually, math is perhaps the most logically interrelated. General arithmetic concepts and processes blend into pre-algebra and algebra in the junior high, and this leads easily into the varied breadth and more difficult courses of the senior high school. However, the controversy over IPI, as we have indicated, runs through the system. Latent in the criticism is more a rejection of the instructional system than of the content per se--which is reasonably traditional. The teachers at the junior and senior high do not like the individualized workbook, minimization of the teachers' instructional role, and elimination of the class as a working teaching/learning group. In this sense articulation becomes not only conceptual/substantive articulation, but instructional articulation.

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[18] As indicated elsewhere, psychology is listed in the category of "Other Courses" along with community service, drivers education, and a counseling mini course.

[19] At one point, Bernstein's (1971) concept of classification seemed to reflect what we were reaching for. His more taxonomic and categorical mode of thought seemed to run cross-grain with ours. An examination and integration awaits a later essay.

Science, too, has its commonalities and differences. The "hands on" philosophy runs through each level, although in some classes more espoused than in use. The "50-50" program in the elementary school leads many teachers into broader "unit teaching" which frequently will combine field trips, reading, projects, and both science and social studies. The flow of concepts across levels seems a major kind of problem. Hierarchical or spiraling relationships are not clear. As teachers in elementary, junior, or senior high school "do their own thing" and have access to a wide range of film strips, films, "packaged experiments," and their own accumulating files of materials and ideas, then one can find electricity in the primary grades, the junior and senior high schools, or find atomic stories, concepts, and measuring devices discussed at multiple levels.

Social studies shifts from more generalized problem solving and accumulation of knowledge exemplified in the Data Bank program at the elementary level to a broad-based history, i.e., American studies at the junior high level. The senior high program is mostly history with some anthropology and contemporary social problems. The historical approach gives a strongly integrated perspective to the senior high program. In the eyes of the faculty, the youngsters "really know some history." The articulation from junior to senior high and the interrelatedness of the high school program around the historical perspective has major advantages. The loss in sophistication of other modes of analysis--contemporary experimental and quantitative social science--poses difficult value, theoretical and evidential problems. For example, is the well-trained-in-history student now ready for a similarly "serious" program in contemporary social science and able to profit from it? Or has he learned a style of thought, more akin to the humanities, and is "forever lost"? Bringing to bear empirical evidence, if that's the kind called for, on such a problem in curriculum, teaching, learning and development seems very difficult.[20]

The interrelation among disciplines is intriguing in its complications. At the elementary level, the project and unit activities seem to be toward the high end of this dimension. In the junior high, the teams (science, math, social studies, and English) are relatively recent in origins and so far seem more organizationally and administratively convenient for pupils, teachers, and administrators. The evolution into curricular and instructional integration seems on the agenda of many of the staff. At the high school, the science department builds heavily on the developing mathematical concepts and computational skills of the youngsters. From the initial quantitative science in the ninth grade on through the Q biology and Q chemistry into physics (which require advanced algebra and trigonometry), the programs are integrated. The math

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[20] One is reminded of C.P. Snow's Two Cultures (1960) and Liam Hudson's studies of clever boys (1966, 1968).

program builds less this way on science. Although in the math classroom observations, several references were made to "how we do it in science." History runs pretty much independently, although we had conversations in which occasional attempts of "history of science" lectures and teaming were carried out.[21]

Running through all of the areas (e.g., the IPI controversy) is minimal teacher first-hand, direct observational/personal knowledge of the program at levels other than one's own. This is true of math, science, and social studies as well. By the simple fact that each level is in a separate building--and some levels have multiple buildings--a profound change occurs. In part it is proximity--simple distance from each other which minimizes contact and interaction. In part, each building has its own environment, its own patrons, its own traditions, its own administrators. To a degree it evolves its own system, as we have argued at several points in the report.

Pupil Movement Through the Curriculum

One of the aspects of formal curriculum, which seems to vary across school districts, is the manner in which the youngsters move through the curriculum. Against a backdrop of state and district minimal requirements, and counsel and advice from the staff, the students in the Alte Schools elect particular courses. As has been indicated, the first options occur in the junior high school in math.[22] In the seventh grade, children (and their parents) are counseled into regular math or pre algebra. In the eighth grade the options are regular math and algebra. The decisions are made by the parents and children; but the major sources of influence are teacher judgments of the child's ability, interest, and probable performance, as well as standardized achievement test scores indicating levels of attainment against both national and local norms. Again it should be emphasized that the final decisions are made by the parents and children. If a parent wants his child in the pre algebra or the regular math, the placement is so made.

This is the first step in what will be an increasingly broadened process of choice and differentiation in what is studied and learned. Increasingly, youngsters move in terms of interest and experience (prerequisites). Geometry isn't taken unless one has had algebra; biology is after one has had Science I or quantitative science (Q Science). The latter presupposes credit (or concurrent enrollment in) algebra. This procedure obtains throughout the math and science program, less so in social studies. In a fundamental sense there is homogeneous grouping by choice--based on motivation, interest, and competence. Competence is defined as experience--satisfactory

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[21]The intent of these comments is to be neither critical nor laudatory, mostly to reflect curiosity. Perhaps there is an empirical literature on these aspects of curriculum integration--both antecedents and consequences. This observer is not aware of it, however.

[22]Also in other domains, e.g., foreign language, but these are beyond the scope of this analysis.

attainment in a prerequisite course. The motivation criterion was commented upon by several teachers as, "There are several youngsters in this class who could be in a more advanced class but they didn't want to work that hard." The interest criterion appears in a number of students who opt for advanced work in other departments, e.g., English or foreign language rather than math or science. Even this has its complications, as one girl commented--"I'm really not interested in science [she was in a senior physics course], but this will be the last science I'll probably take. I'm hoping to major in foreign language in college." She indicated she had already been accepted in an Eastern school.

In Alte these choices are not complicated by race or socio-economic factors. The community is homogeneous in these regards. Sexism, if present, is institutionalized. The choices are possible; however, fewer girls than boys take advanced science and math. A number of teachers take strong value positions here. One teacher commented about self images of female students.

> The girls say "I'm not good at math" and find excuses not to continue studying it. But the boys say "I think I could get it--I just don't study hard enough." I have been working with the girls, and I might have gotten a few back on the right road this year.

If these comments are veridical, if one subscribes to the value position that equal numbers of girls should be moving toward professions involving science and math and if the youngster's parents agree, then the attitudinal roots lie, in part, well before the curricular choices in the high school.

Summary

Over the years, educational psychologists of a measurement persuasion have had an ambivalent relationship, with disdain perhaps the modal sentiment, to accrediting agencies such as North Central and instruments such as the Evaluative Criteria (NSSEE, 1969). Rating scales have their own intrinsic problems with inter-observer reliabilities, definitions of end points, and equality of internals in between. Further, ratings of schools, classroom events, and teaching do not correlate well with results of achievement tests. In the present discussion of formal curriculum and the attempt to highlight dimensions, the skeptic might see nothing more than the rediscovery of the Evaluative Criteria.[23] Perhaps that is so. And maybe it's a good thing as well. As we have looked at the Alte Schools, from the perspective of a hundred years, they have changed in some remarkable ways. This has been an attempt to talk more precisely about those similarities and differences. Precision in theory and language may even be a precursor to precision in measurement and lead to a renewed, but altered, attack on significant educational problems.

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[23]Our intentions had been to take seriously this doubt, which we share, and our belief that a major underanalyzed issue lurks within. That essay must await another occasion.

Informal Curriculum: Degree of Enrichment

The teachers and the administrators in the Alte District do a number of "extra," "additional," "enrichment" activities with the children. Essentially they are components of the curriculum which occur outside of the regular course content. It's difficult to find an appropriate label but "informal curriculum" or "enrichment curriculum" might qualify. Similarly, it is difficult to imagine how one might measure this attribute of a district's curriculum effort. Perhaps by presenting two illustrations we can capture some of the flavor of the phenomenon. The first is the community history carried out by the junior high pupils and their social studies teacher. This resulted in the formal publication, Images of Our Community--Alte. In some ways it paralleled a 1931 document, The Story of Alte, which was also published. While we do not have base rate data, two published social studies documents by junior high pupils seems rare and unusual. The second project is much larger, more complex, less unified and spreads all through the district. Roughly, it might be entitled outdoor education. It includes such varied activities as sixth-grade camp, junior high school all-day canoe float trip on a nearby river, several different summer programs in ecology, and environmental studies with kindergarteners, elementary, and junior and senior high school pupils.

Outdoor Education

From the initial interviews with the principals early in the semester we began to hear about Alte's Outdoor Education Program. The program is diverse and extensive in time--fall, winter, spring, and summer. Rough categories of activities are listed in Figure 14.

Insert Figure 14 about here

Instead of a detailed account of the total program, brief experiences in which the observer participated will be described.

The Alte School District has had "sixth grade camps" for several decades. In recent years it has evolved into a quite complex undertaking.[24] It is planned and run by two district administrators. It is staffed by all the sixth grade teachers and by other staff interested in outdoor education who come part time to the camp from all levels (elementary, junior, and senior high) and

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[24] The story of this evolution, as we came to hear it, suggests the generality of most of the theoretical ideas developed out of the IPI illustration earlier in the report.

	Arboretum Activities	Arboretum Activities
	Mini Courses: Counseling	Counselors in Training
Arboretum Activities		Alternative School Program 1. Ornithology trips 2. Cabin rebuilding 3. Local town history
One Day Overnight	Overnight	
Sixth Grade Camp		
Summer Program (Kgn. & 1st Grade)	Four Week Summer Program	Summer Camping Climbing, Exploring
Elementary Level	Junior High School	Senior High School

Figure 14. Outdoor Education - Alte 1977

all areas (industrial arts, mathematics, foreign language, etc.). In addition, high school youngsters are counselor aides. The program is structured around four major "days" of activity.

1. Potpourri Journey
   1) Orienteering
   2) Outdoor Project
2. Nature Journey
   1) Pond
   2) Forest
3. Cave and Lake Journey
4. Bluff and Creek Journey

An illustrative anecdote or two brings to life a bit of the quality of the experience as the observer participated in a morning's canoeing and an afternoon's nature journey.[25] From the summary observation notes an incident or two are excerpted.

> There's another long episode that I don't think I got into these notes yet. As I glanced over some of the field notes from yesterday there was a reference to the turtles. It's part of the collecting enterprise. As we were roaring off in the van, going to the canoeing area, we went by a big turtle on the road. The driver stopped and one of the teachers got out and brought it into the van. It was going to be added to the collection. Later we found another. All on the way to canoeing. The kids were interested and played with the animal, watching it as it moved...
>
> While we were on the lake in the canoes, we spotted a number of water turtles with a much flatter back and body, sunning themselves on logs and stumps. In one spot there must have been a half dozen. The kids all paddled over to have a look. I was surprised that the turtles were not skittish. The kids got up quite close before they took off.
>
> We also discovered another box turtle about fifteen or twenty feet or more out in the lake, swimming in the "wrong" direction, as it were, toward the other side. We circled around as the girls in another canoe made one pass at it and missed it, then we picked it up on a paddle. It was a small one, and we gave it to one of the girls. The important point I want to make about this story is the tremendous involvement and interest that the kids displayed in the animal when they got to the beach where

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[25] When he arrived early in the AM, the observer was greeted by the Camp Director with, "How about helping out with the canoeing and caving trip?" A month earlier we had been involved together in a day-long canoe float mini course.

> we were to await the others and have lunch. Anywhere from two to six or seven of the kids literally played for half an hour with the turtle. They built a sand castle and would suspend the turtle on it and then while the water washed the sand away they would watch him move to and fro and about. Similarly they built runways for him and engaged him in turtle swimming, turtle climbing, turtle walking, turtle falling, etc. Again, a full half hour. He was brought over to join us for picnic lunch. All in all, he became one of the major foci of activity...There was a bit of that kind of spontaneous activity that seemed to be going on everywhere.... It got integrated with other activities.... The turtle eventually ended up in the Nature Lodge with the frogs and toads and tadpoles and all kinds of water beetles and diving bugs.

The story is a small one, and just one of dozens, if not hundreds, that the sixth grade youngsters experienced during the week.

The Nature Lodge was developed primarily by staff and students from the Alternative High School. The notes try to describe it.

> The nature study center was probably one of the most creative and biggest hits of the whole week. The teacher and a half dozen of his kids brought out a whole set of equipment and materials and set up shop in one of the out buildings...empty acquariums, work tools, a library. It was an incredible picture.... And everyone seemed to be working in, working on, and working about with the materials....
>
> Briefly, they had a microscope that gave two to twenty magnifications. They had that down at the pond where they were collecting specimens. The good microscope, three hundred power (?), was at the Nature Lodge. The inside room was set up with a row of cages for animals they had collected--at least three kinds of snakes (black, garter, etc.), a spider with a big cocoon of eggs, a big black spider, and all kinds of beetles and bugs. Apparently, last night they set up some kind of night light that had an eerie sort of glow about it, and attracted all kinds of insects which they caught, and put in test tubes, and are currently looking at, examining and identifying, etc.... They had set up a table with a library of books on trees, birds, flowers, shrubs, insects and you name it. One of the high school girls was doing what she called a "transect," a kind of census on a strip of land running through the park. She is trying to identify every living thing within one square foot and then another, etc. I don't know all the details, but the census seems based on a reasonably common set of procedures and seems to have no big difficulties inherent in it. The image she

> conveyed was that of a busy working scientist. The job was a real one, the task was difficult in that the array of insects, wild life, flowers, etc. is very great....
>
> Outside, in a kind of breezeway, also was a kids' wading pool, into which they had put a lot of rocks, water, and their specimens. They had toads, frogs, newts, some kind of diving beetles, turtles, and everything that moves that they could get their hands on....
>
> Inside, a teacher and some of the high school students with some occasional help from some sixth graders were building a cage for a new snake they had caught when they were down at the pond. They had some heavy wire mesh and a pair of wire cutters. They clipped and bent and shaped the wire mesh as a lid for one of the aquariums. They put leaves, logs, and other stuff into it for a habitat.

The story goes on and on. Tentative generalizations arose and moved in a myriad of directions as the observer tried to come to grips with the experience as an aspect of science education. For instance, (and, once again, from the summary notes):

> The contrast of this kind of experience and the ESS experience and a more textbook experience is one that needs to be looked at and brought out with intensity and beauty. . . Two or three dimensions . . .play back and forth here: the realism of the problems, the hands on aspects, the total living experience, the kids' contributions....

And at another point:

> One of the bigger generalizations I guess I've made about outdoor education as it's practiced in Alte is that it's really the Boy Scouts come to the public schools.[26] I can't get over how many experiences I had in scouting--both in the sense of taking it seriously as a youngster and doing a lot of things on our own in conjunction with the program--which are occurring or happening with the kids here.
>
> There's a very interesting complex of experience that really needs to be checked out in some ways more fully and carefully. It blends into the kind of quality of

---

[26] Several staff members took strong exception to this kind of crass reduction.

> life that people might live, it ties in with rounding out the more general development of the kids beyond the sort of things they get in the high pressure, academic excellence type of program.[27]

The final notes of the day stated and understated. "It's been a profitable day. And a bit of fun, too."

Community History Project

Serendipity is both a process within, and a joy of participant observational research. Early on, the observer was hunting for documents on the history of the Alte Schools. A librarian put him on to Images of Our Community - Alte, a publication "By Members of the Alte Junior High School," an intriguing document in its own right. In turn, it became the basis of a number of conversations and interviews which revealed additional aspects of social science education in the Alte Schools.

The booklet itself is a sophisticated piece of work--historically and pedagogically. The initial paragraph of the Introduction is a first instance.

> We have entitled our booklet "Images of Our Community - Alte." Perhaps we can never discover the "complete" history of Alte. Perhaps history is only a collection of images. We do know that communities have "images," but we are more interested in the people behind the community images. We have studied the images of our community here in Alte and have spoken with many people who gave our community its life and meaning.

The introduction was written by two of the students. Each section of one to several pages carries the name of its student author.

The problems faced in getting themselves organized to do this were ubiquitous. "What to do? and How to accomplish it?" were the broad categories of issues. Should it be an in-class or out-of-class project? How to foster and handle the emerging leadership of the youngsters? Relationship with a similar project in the community--and the not so latent competition for data, for pictures, for getting finished on schedule were also problems. These issues merged with problems "in the field." Who to interview? What to ask about? How to get permission? How to handle the "emperor's new clothes" phenomenon: the youngsters' unawareness of some of their elders' sensitivities and prejudices, growing awareness of the implications of some of the direct and frank questions, the issues, the problems.

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[27]Later comments were made on the difficulties in measuring, assessing, and testing some of the implications of such hypotheses.

The methods were a blend of oral history and primary and secondary sources. The faculty sponsor, a junior high social studies teacher, taught the children how to do oral history--techniques from his own graduate school background. He dittoed a set of "tips," do's and don't's from Baum's pamphlet on oral history and the interview process. They worked out lists of people to see and eventually taped over two dozen interviews of present and former citizens. Several major primary documents, local newspapers, were available only from the State Historical Society. Microfilm copies were secured and scanned by pupils who were "microfilm readers."

The content carries the stamp of the youngsters' knowledge--a dedication to their teacher, a listing of staff, and acknowledgements. The content breaks out into "The early years," "Alte and its people," "Alte's curiosities," "Alte's future," and a "Conclusion." It's full of pictures, anecdotes, stories, and descriptions. The oral histories produced page after page of delightful quotes:

> I don't think the roaring twenties changed Alte too much. I think that everybody that had any "roaring" to do went out of Alte to do it.

And, it also produced delightful stories of pioneer ancestors, e.g., the lady who fell into a cistern with her child and stood neck high in water, holding her four year old on her shoulders until her husband came home for lunch five hours later. Nor did the youngsters shy away from more controversial issues of race, religion, and commercial development encroaching on residential neighborhoods.

The origins and consequences of the project are multiple. Without elaboration these have been sketched in Figure 15.

Insert Figure 15 about here

The story is both richer and more dramatic than our account. The complications within the school, the larger district, and the historical context are part of that story. Suffice it to say, it was a major educational effort.

Curricular Competition for Time, Energy, and Enthusiasm

In the course of the semester a number of comments were made by teachers about the Community Science Fair, a metropolitan exhibition of projects, awarding of ribbons and prizes, and local hoopla. The teachers in Alte have participated minimally in recent years. Their feelings were expressed in such comments: "It's a parent thing," "It's a mess," "Some kids didn't do anything else all year," "I'm glad we're out of it," "Don't get us back in that."

While our data aren't extensive, a variety of factors seem to be at work. The major one seems to be a waning of interest and

Precedent from the 1931 Project
A group of able and interested pupils
Teacher with imagination, interest, skills in historical method
Administrative support/ challenge/criticism
Unique moment: Centennial and Bicentennial
Initiation and Completion of Community History Project
Community
Pupils = Learning Excitement
Staff
3-56

Figure 15. Antecedents and Consequences of the Community History Project

enthusiasm over the years. Novelty is obviously a major motivator of teachers and children. Having done it before--a dozen or more times for an experienced teacher or several times as a pupil--becomes a powerful determinant on the "next time around." It has little to do with the intrinsic merit of the activity itself. In addition, other activities, with equally good intrinsic merit--"outdoor education," a day long bus trip to Chicago's Museum of Science and Industry for the junior high school pupil, or a special program such as "Truman Day" or an "Individual Choice--Mini Courses" set of experiences--arrive on the scene. These capture the attention and imagination of staff, students, and parents and bring their own benefits, problems, and costs. In Figure 16, a partial listing occurs of some of those we participated in, ran into, or heard about in conversations.

Insert Figure 16 about here

It's difficult to resist talking about our entering into a debate with some very talented youngsters on whether President Truman should have dropped atomic bombs on Hiroshima and Nagasaki and the attempt to sort out issues of fact from issues of value and the weighting of each into a coherent argument. Similarly, a day float on a lovely Ozark river, the excitement and anxiety in an overturned canoe under a windfall in the main channel, the lazy picnic lunch, the cave exploration, and the long paddle to the take-out point. And the parental comments of the kids' pleasure in the activities and in getting to know further dimensions of their teachers. Or finally, an evening at a metric fair where we found out how far--in kilometers--it is from Alte to New Zealand and London, how much we weigh in kilograms, and how complicated the translation from English to metric units is when the translations are built into puzzles.

Conclusion

Conceptually, several critical conclusions seem embedded in the description and analysis. First, the category of events seems half way between the formal curriculum and what is generally called extra curricular activities. The community history project is more of a long episodic/one shot phenomenon. The outdoor education program is more entangled with the regular program--especially in science. It is evolving, changing, shifting about. At this point it's not clear whether it will eventually be institutionalized as part of the formal curriculum or separated out as an extra-curricular activity. As such, its importance conceptually may lie in its quality as a case study of curriculum change.

1. Outdoor education
2. Community history project
3. Metric fair
4. Mini course day
5. Metropolitan math competition
6. Science fair
7. All day trip to the Chicago Museum
8. Truman Day

Figure 16. Enrichment Activities in Science Education

The illustrations and analyses have been too brief.[28] These instances of informal curriculum play back through the earlier dimensions of curriculum, e.g., interrelatedness between elementary and junior high and between junior and senior high schools and breadth of curriculum. They also suggest other dimensions--involvement with community, parents, applications outside the school, and more general personal development.

Curriculum as What is Taught: Vignettes of Teachers and Teaching

Very early in a conversation with one of the teachers the concept of formal curriculum came under attack. In his view, going through course labels missed the point of the quality of what is taught at Alte High and its superiority to what is taught under the same course label at other high schools in the community. Whether Alte is that much better than other places requires data beyond what has been gathered in this case study. The point, though, is an important one; it seems to have several aspects. First, what is taught might be presented best by a careful analysis of (1) textual and other instructional materials--readings, films, laboratory exercises; (2) in-class reporting of pupil teacher interaction (monologues, dialogues, questions, etc.): and (3) student thinking, writing, and examination responses. For purposes of brevity, a half dozen vignettes--across grade levels, disciplines, and schools--will be presented.

Beside capturing pieces of the realities of what is taught beyond the course labels, the vignettes raise directly an aspect of latent curriculum, the idiosyncratic styles of teaching. The Alte Schools have some "living legends" whose classroom personalities and styles are important variables. In the research literature these seldom are described carefully and are nearly impossible to measure adequately with currently available techniques. Our hypothesis is that they contribute significantly to pupil personality development--aspects of learning and achievement including and beyond what is usually measured in standardized tests.

Quality of Mind: Teacher A

One of the science teachers, a former student and old friend from years ago, enjoyed seeing the observer about the building. We had coffee and conversation on a number of occasions. In the course of the semester and over the half dozen visits he brought reprints of things he ran into in science education which might be pertinent to the investigation and which the observer, as a non

---

[28] Once again a major essay lurks within these programs, their antecedents and consequences. In part, we need more data; mostly, however, more time for analysis and write up.

science educator, might not run into. Typically, they would be accompanied by a note or comment.

> "For your NSF program--I don't recommend these articles--Please eventually return the magazine. No hurry."

And so it went all semester. A sampling of titles appears in Figure 17. Most were from Science, the journal of AAAS, from

---

Insert Figure 17 about here

Science and Children, and from The Science Teacher. A few were local items.

The point, though, is not one of methodological help, as important as that was; the point is the evidence of the quality of mind possessed by one teacher, idiosyncratic but not atypical of the staff. Which teachers read? How much? What kinds of things? How important is it? For what kinds of consequences? How easy is it to change? By what procedures? All these become relevant questions regarding the broader issues of science education and the quality of teaching and learning in the schools. They seem implicit in this simple set of events, a science teacher passing along relevant items to an old friend.

The Other Half of Math: Mrs. B[29]

Not all math in the elementary schools is IPI nor is it text book bound. By chance, and unannounced, one morning in the course of trying to sample broadly, the observer viewed a "math lesson." Actually, the morning was supposed to be language arts, spelling, and art. But the teacher commented, "As long as you're here we can do some math. I was planning it for after lunch but we can try it now." The observer settled in, out of the way, and made a few preliminary notes.

> She has about 25 kids in what is a 2 1/2-3 classroom space.

Actually the room was constructed from two classrooms. When the walls had been taken out the extra part came from a large cloak room which was now part of the classroom. In addition, since the area was at the end of one of the legs of a "u"-shaped building, the original hallway became an "anteroom" with overstuffed chairs, tables, storage, and spillover for pupil activities. The notes continued:

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[29] Until this project the observer had never met Mrs. B.

1. "Activity Oriented Science, Is It Really That Good?"
2. "National Academy of Sciences: How the Elite Choose Their Peers"
3. "Aftermath of the New Math: Its Originators Defend It"
4. "The Emergence of Ecology as a New Integrative Discipline"
5. "Social Anthropologists Learn to be Scientific"
6. "Farming Communities and the Demands of Archeology"
7. "Science: Too Much Accountability"
8. "Atkinson to Head NSF?"
9. "TOTSI Matches Teacher to Curriculum"
10. "Teachers Who Care"

Figure 17. References thought to be "of interest" to an NSF investigator of science education

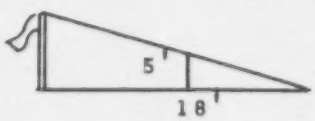
> Room looks like something out of Elwyn Richardson or Ellsworth Collings: (1) variety of mobiles hanging from ceiling, (2) plants on south window sills, (3) pictures, photos, maps of science everywhere, (4) at least six expensive microscopes on side tables.

The references to Richardson (1972) and Collings (1926) are to two of the clearest and most vivid statements of "activity" or "project" curricula. Richardson writes of his experience in combining art and science in the education of Maori children in rural New Zealand. The point of view is part of the elementary curriculum in teachers colleges there.[30] The Collings book was an early progressive education experiment in rural Missouri carried out some sixty years ago under the direction of W. H. Kilpatrick. Seeing those ideas come alive in a sophisticated, well-to-do upper middle class suburban community raises a series of provocative questions.

After taking care of attendance and lunch count, the teacher began. The notes continued with a mix of quotes and summary description:

> "We'll do a little more on measurement. Need paper, pencils, and protractors."
>
> Kids make mad rush for box in the back of the room. Several protractors short. Partners.
>
> "Name in upper right hand corner. Title for this paper 'Indirect Measurement.'"

This was demonstrated using an overhead projector and a method of printing with a ruler as base for level printing. Concomitantly a discussion was underway on the meaning of "indirect measurement." After a comment or two, one of the pupils suggested, "Can't do it directly, next to it." She talked as she drew on the overhead projector. The observer caught a series of phrases in a discussion which moved too fast:



> "Review ...lying down flat a five foot pole seems as high as flag pole top...one or two eyes...[one] ...What called? ...[Parallax] ...someone generate some numbers...bottom line of small triangle 18 feet... What is unknown? ...[Height of flag pole] ... Instead

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[30] The observer spent a year at Massey University in New Zealand on a Fulbright-Hayes research fellowship. While there, he visited a number of teachers' colleges, secondary schools, and elementary schools, some of which were mostly Maori.

of question mark we call it X... Between you and me it's like algebra... Need one more piece of information...[31 ft] all right length 31 feet... Can I convince you to make it a little bigger. If this is 18 then, how about 46... What do I do now...Bunch of show offs, you can't do it."

Kids volunteer 5/18
Talks about the "little triangle."
Kids pop it right out "5/18 is like X/46"
"18 X = 5 X 46"
"18 X = 230"
"Here's a tricky one..."
"Can't throw anything away X = $18\overline{)230}$"
Kids do it
"What if there's a remainder?"
She divides with their help
X = ~~12~~ 13'
"Since it's so close and since 'guesstimates,' make it 13'."
She then integrates back to earlier lessons with a "Who thinks they have it down for last two problems?"
Most say "yes." "Save for your folder."

At this point it was 9:02, and the rapidly moving lesson moved on. A couple of comments and everyone was in motion again. "Need scrap paper for new problem," sent most back to the shelf where the one side of used ditto paper is kept. "Where's my gizmo?" had a pupil off to her desk for what she calls her "gravity protractor"; that is, a large wooden protractor (normally for drawing angles on the chalk board) with a hollow tube (from a role of foil) taped to the base and with a piece of coat hanger swiveling loosely in a hold at the origin. In the next thirty minutes, the pupils drew several horizontal lines on their scrap paper, did perpendiculars, had a side lesson on the problems of using ink and smearing, talked about right angle and 90°, and angles that were half that--45°. She raised the label "hypotenuse," they got its spelling from the dictionary; she helped kids who got angles wrong, challenged "check angle there; bet you dollars to donuts it's not 45°," and encouraged "Fantastic, you guys aren't supposed to know so much." The observer's interpretive aside.

(Obs - She's a real pro at this informal activity-oriented style. Kids busy, interested, full of relevant info re geometry, math--degrees, angles, hypotenuse, 90° = rt angle, etc.)

She continued checking around the room, commenting, helping, and having individuals redo if the triangles were too small or if the angles were not 45°.

She brought the class' attention together with a comment, "Look...this is important...measure the sides opposite the hypotenuse." As she drew helpful arrows on one of her triangles, one of the pupils piped up with "What system?" and she replied, "Let's do it in centimeters." Shortly she asked and commented, "Think there's a relationship?" and "All right Mr. Pythagoras." Shortly, "these two are the same," popped up in several places. Amongst the questions and comments of "rounding," "sloppiness some where." She again drew the group's attention:

> "Ok, drop everything.... Let's write us a law... Thursday morning law...other sides, not hypotenuse, are the same.... How many got the same or nearly?... Everybody happy?... (yes).... If that is true is there any way to use it to measure?"

Then she drew a picture on the overhead projector of a flag pole, with flag flying in the breeze. "Call it X." A discussion ensues, a pupil has a difficult time expressing the 45° angle. "You're all right, it's hard to put in words." The discussion continues about different distances and needing some way to measure angle, a giant protractor. With a flourish, the home-made instrument is introduced--"Level it's 90°. When I tilt what happens? The children respond, "The needle changes." The action continues:

> "Can this help me?"
> "Yeah."
> "Can you make one of these?"
> "Poke a little hole in the protractor."
> "String and weight."

The discussion continued to move too swiftly for the observer's pencil and pad. In the next few minutes questions were raised regarding the adequacy of the law, "eye level at five feet," and the need to lie on the ground, more pictures on the overhead identifying the two 45° angles, a hypothetical ground measure of thirty feet, and an immediate pupil response that the flag pole must be thirty feet high.

At 9:38, almost an hour into the lesson, another major shift occurs. One pupil is sent to the LRC with the message that they will be down later. As she gets them ready for making their own gravity protractor, she sets the array of related and continuing tasks: 1. draw the 30' flag pole illustration in their notebooks;
2. finish their sun dials;[31]
3. make gravity protractors.

---

[31] Methodologically this seemed very critical. Earlier the observer had some concerns that he was being given a "special performance"; the sun dials were an even more elaborate project. In addition, parents reported on the excitement their children felt in being in her class. The activity was not atypical.

The next forty minutes were occupied with construction activities. An alcohol lamp was brought out to heat a needle for putting a hole in the plastic protractors. One pupil went for plastic soda straws for the tube. Multiple ways of attaching tubes to protractors were tried. Freezer tape was the most prevalent. Multiple devices for the gravity indicator were tried. Bent paper clips and thread with a metal washer as weight seemed to vie in popularity. The observer noted, "Everyone's moving. All busy." Along the way casual comments of the children were noted. They fit a number of categories:

> "Straws are here."
> "Bill, will you bend my paper clip?"
> "Are we going to get into X^2 and all that stuff?"
> "Let's go watch him pyro off!"

Through all this, the teacher moves about, helping, explaining, giving side lessons (e.g., how to use a pliers for wide or tight grip, the hottest part of flame, etc.), and raising related ideas (e.g., ping pong ball as possible weight, problems with wind, use angle to measure wind speed). The observer noted:

> (Obs - She's a provocative, thoughtful, creative gal. Seems to have an easy way with kids. Can build on their ideas. That's a most important skill, in ele, h.s., graduate school. Need to work that out conceptually).
>
> (Obs - The multiple activities keeps kids on all kinds of productive work.)

The lesson ends at 10:20, as materials are put away, as kids who have gone outside to try their gravity protractors are rounded up and as they get ready for language arts.[32]

Quantitative Biology: Miss C

The strength of a methodology which combines direct observation, informal teacher interviews, and a collection of documents seems well illustrated in Miss C's biology class. The field notes begin in the morning before class.

> Been in a few minutes in Miss C's class. Lab this AM, a two period module. She's busy with "popping beads"; as we joke, she attributes them to a geneticist working with BSCS, an NSF project: "Good enough for them; good enough for us."

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[32]Almost as if to say, "You've hardly started," she commented about IPI as a teaching tool and liking to teach her own math, of integrating social studies with mythology, and of her conception, with diagram and all, of a theory of knowledge for organizing all of the elementary curricula. That has to await another day--and another essay.

As the kids straggle in, I look at Drosophila manuals:

Kaufman, R.P. Drosophila Guide (8th ed.) 1969;
Carolina Drosophila Manual, 1973.

Meanwhile, two other science teachers who share the lab and/or adjoining office facilities are in and out attending to chores.

When the students are in and attendance taken, the teacher begins a brief discussion of the experiment of the day. She relates it to earlier work on mitosis. She indicates the difficulties of "doing meiosis experimentally," therefore the popping beads. In short order, she has a diagram sketch on the board and has raised the concepts: chromosomes, gene, double chromatid, tetrad, chiasmata, spindle, and metaphase. Shortly, in small groups of four or five at the lab tables they begin "Investigation #11: Models to Illustrate meiosis and fertilization." Two brief quotes from the worksheet indicate the level of intellectual sophistication demanded:

> In the case of fertilization, what we need most to realize is how the random union of different kinds of male reproductive cells, or gametes, with different kinds of female reproductive cells will turn out.
>
> In the case of meiosis, we need to see how these different kinds of gametes are produced by a single diploid individual, through the synapsis and segregation of homologous chromosomes, with or without crossing over between them; and with independent behavior of different pairs of chromosomes.
>
> Because in the flowering plants and in animals, in general, meiosis leads directly to the production of the gametes (sperms and eggs), and fertilization results when sperm unites with egg, we shall take the model of meiosis first.

And later:

> Meiosis always requires two successive cell divisions, so that from each diploid cell that enters meiosis always a quartet of monoploid cells results. (It is not correct to talk about a reduction division--there are always two, one after the other, to complete the process.) In the first division of meiosis, while each chromosome replicates itself and consists of two twin strands (chromatids) held together at the centromere, the homologous chromosomes...

A brief interpretive aside captures a reaction relevant to this general point.

(Obs - For me to follow the substance I would need to read a bit beforehand.)

The notes pick up the student activity:

Kids keep lab books, work cooperatively by pairs of tables. Each of four tables has five or six kids. Miss C suggests one reader and several others doing. She floats around and helps. The group at my table seems to differentiate into those who have read and know what they are about [one boy and one girl]; others read, half follow, and occasionally question.

During the experiment the teacher stops to chat with the observer. "Miss C clues me in." Several points recorded in the notes represent a part of her outlook on Alte's science program.

1. Distinctive aspect is "hands on" approach.
2. In recent years, a shift in kids from quantitative biology to general biology--four sections vs. six sections. Used to be the reverse. She attributes to lower parent expectations and the fact that an able kid might get a three or four in general biology but only a two or three in quantitative biology. The kids want the higher grade average, regardless of learning, for the college admissions race. I asked re a possible 50% A's vs. 25% A's in different levels. This they do not do.[33] Spread in both. Seldom, however, is there an F in quantitative biology.
3. She shows me the lab books which she wants to be like a working scientist's lab book: notes and pre lab on the left and data, results and conclusions on the right, etc. (Obs - I'm reminded of a library exhibit of physicist Arthur Compton's lab books. I wonder re these as models: sources, generality, variety, etc.) The books are full of red ink. She spends a lot of time marking, grading, reacting. Last night she had to get some done for this a.m.
4. Talks of better facilities in other schools. Labs here are jammed with kids, apparatus, other experiments (planaria and fruit flies) from biology; also some from other courses.[34]

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[33]Some inconsistency exists regarding this and other courses in the program, according to other teachers' comments. No examination was made of actual grade distributions.

[34]A similar point was made by one of the site visiting teams, who commented regarding lack of space for live materials--greenhouses and animal rooms. In terms of resources, some parts of the high school are less adequate than the elementary and junior high school facilities.

Toward the end of the period a final comment or two was made in the notes:

> One of five here seems out of it to me. Another asks, "What's wrong?" She replies, "I don't know what's going on." Miss C hasn't picked her up yet (time spent talking to me?). Leader of group activity is extremely able, according to Miss C.
>
> Kids gradually getting organized to leave, finish up, talk quietly. No bells, they gradually drift out. Tuesday is the period and a half.
>
> (Obs - The difference between here and in the Alternative School are immense.[35] The program here seems vigorous, intellectual, challenging. Can make of it whatever one wants.)

Almost as if to make that last interpretation with an exclamation point, an assignment sheet was given to the observer as he engaged in some brief chit chat with the teacher while closing out the observation. It appears as Figure 18.

Insert Figure 18 about here

A final entry in the notes reads:

> I go over to look at Planaria. Talk to Miss C and pick up assignment sheet, note text, quizzes, labs, supplementary reading, other materials.

A Traditional Textbook Lesson: Mr. D[36]

When one is away from classroom settings it is easy to be ideological about the intrinsic goodness of one mode of approach to teaching or the inherent evils in another. The observer saw several "classical" textbook lessons, one of these was in a slower algebra section. Mr. D was substituting for a fellow teacher who was out for the day and because "The subs won't come first hour." Before class, he was tutoring two youngsters, one on each side. The notes pick up the interaction:

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[35] The week before the observer had been in the Alte Alternative School. More on that later.

[36] This and the remaining vignettes are shortened to just a glimpse for reasons of space and time. In the observer's eyes they were "stunning" performances and required more extended description and analyses.

Biology 6th week second semester Feb. 22 - Feb. 25, 1977
7th week second semester Feb. 28 - March 4, 1977

Text:
1st part Chapter # 13 - Reproduction--pages 299-311 Quiz on or after Feb. 28, 1977

2nd part Chapter # 13 - Reproduction--pages 311-321 Quiz on or after March 7, 1977

Supplementary reading:
Quiz on or after Feb. 28, 1977 -- Protopsychology, by Best, Sci. Amer., Feb., 1963

Memory transfer through cannabilism in planarians, by McConnell, Jour. of Neuropath. Aug., 62

Quiz on or after March 7, 1977 -- Moment of fertilization, by Allen, Sci. Amer. July, 1959

"Fertilization" by Metz, Frontiers of Modern Biology pp. 132-142

Laboratory:
Complete Lab S-18 Behavior of a Slime Mold -- Write-up due -- February 28, 1977

Continue Lab 14-16 Regeneration in Planarians -- note references above.
Each team will be responsible for a 1/5 page summary of their part of investigation

Mimoegraphed Lab -- Models to illustrate meiosis and fertilization
Popit bead Lab -- complete diagrams of each step of meiotic cell div.

Lab 13-6 Inv. reproduction in flowering plants -- Lab S-9 Growth of pollen goes with 13-6
Reference: Germination of lilly pollen respiration and tube growth, by Dickinson Science, Dec. 31, 1965

Lab 13-10 Inv. the life cycle of insects -- Observe development of this lab for two - three weeks. Note reference -- Drosophila guide

Other materials:

Mitosis and meiosis, programmed text

Structure and function of the cell, programmed text

Pollen, by Echlin, Sci. Amer., April, 1968

Germination, by Koller, Sci. Amer., April, 1959

The fertilization of flowers, by Grant, Sci. Amer., June, 1961

Lab report due -- Feb. 28, 1977
Lab S-18 Behavior of a Slime Mold

Figure 18. The Assignment Sheet From Quantitative Biology

They go back and forth re problems.
"Do you have the same thing I do?"
They do.
"Simplify both."

8:15 Most kids in and out. They ask about test papers and scores. Re one fellow who missed test and the teacher pins down carefully re his free period which is 7th hour. "Be sure and be there," he says.
(Obs - He has an easy but definite way.)

8:20 "OK, attention please. Try to do three things.
1. check paper
2. new material, division of binomials
3. do some problems in class; 15 at home."

They move quickly through the problems from the test. He stops and works those that are more complicated and have given a number of the students difficulty, for example:

#22 Pretty fancy
$4w(w - 3)^2$
First, square the binomial, how many, $(w - 3)(w - 3)$?
$(w - 3)(w - 3)$
$4w(w^2 - 6w + 9)$
$4w^3 - 24w^2 + 36w$.

As they work through the problem, he calls on different youngsters, seems to know about half of them, occasionally comments, "Don't have much time" and "Joe, if I have to stop and yell...," and continues the rapid pace.

The new materials begin about 8:35. A simple illustration of 16/2 = 8, the check for it, 8 X 2 = 16, and the comment, "Think exactly like that." Together, with the teacher in the lead, they work a series of problems of increasing difficulty.

X^3/X^2, $6a^2/3a$, $-15c^5/-3c$, $18d^2/+6d^2$, $20ac^3/-5ac$

Throughout, running comments of the teacher appear:

"I'm getting tricky."
"Close, write it down."
"Ask someone for help."
"Lot like the other."
"Look at this part." (He boxes the element.)
"Come up with a rule."

As they come to problems with the denominator larger than the numerator, he comments, "a little different approach," demonstrates on the board, and remarks:

$3/12 = \frac{3 \cdot 1}{3 \cdot 4}$, pair this $\frac{(3)}{(3)}$, simplified version is 1/4

$\frac{X^3}{X^5} = \frac{X}{X^2}$, almost, $\frac{1 \cdot X^3}{X^2 \cdot X^3} = 1/X^2$

And later,

"Let's do a couple more before giving the rule."

After presenting the rule, he moves toward a total class exercise, in which he writes a dozen problems on the board, mixes up the kinds, and has the kids close their books and do them on scratch paper. He moves about the room checking individual papers. The observer reflected:

> (Obs - Teacher in motion. Responds to one kid's initiation--hand up. Personalized interaction! Extend analysis from Complexities. Different kind of thinking? Big issue.)

They begin on their homework in the remaining few minutes. As the bell rings he reminds them that their regular teacher will be back tomorrow.

Adversarial Teaching: Mr. E

Ostensibly it was a review lesson to help the students in a western civilization class write better essays on Magna Carta. The original assignment was:

> Utilizing the essay on Magna Carta by S. Painter,[37] show how the document brought forth:
> 1. the concept of limited sovereignty
> 2. the concept of "Right of Rebellion"
> 3. The concept of "consent of the governed"
> 4. the concept of "due Process of Law"
> In your essay cite specific examples taken from the readings to illustrate your points.

The class began at 10:04 with Mr. E passing out copies of the article, which the class had read previously, and asking, "Where in the article can we find questions?" and then the discussion moved too rapidly for complete note taking by the observer:

> Limited sovereignty - page and paragraph?
> Consent?
> Look at four questions?

---

[37] Originally published in The American Historical Review, 1947, 53, 42-49.

(Obs - He pushes kids to look carefully. Kids seem with it.)

Page 249, last paragraph...could never be an absolute ruler. . . . What is there about a contract? ...Definition of contract? Where are my Latin scholars?...

He illustrates with a brief comment about marriage contracts, eventually pulls "an agreement between two or more parties" from one of the pupils. He extends with, "Cannot be broken by one... neither party can violate it...limits...even a king can't violate it." Rapidly, aspects of "written vs oral...equally binding..., Henry 1st Charter of Liberties...Barons thought binding on Henry and all the succeeding kings" are raised. The observer commented:

(Obs - He raises his voice, almost yells, then quiet again).

What are Barons saying?...You have ignored your grandfather's contract. We'll write this one...let's look at King John's position...

(Obs - In effect, he's telling a story, a narrative of west. civ. with some highlights. Story telling[38].)

The lecture/discussion continues, contrasts to American history are raised re constitution, Lincoln and the Civil War, and Nixon and Watergate. Then he's back to King John. At 10:35 he shifts to "right of rebellion." "Is it in the Constitution?" One of the youngsters vacillates. And he's back at Washington, Jefferson, Madison, and "Did you take American history? Did you study the Constitution?" The observer commented in the notes after these self evident rhetorical questions.

(Obs - He crowds individuals and class intellectually, e.g., what happened to your rights of rebellion? Very different strategy in teaching here than with Mr. F.[39] He really probes hard.)

(Obs - He offers kids a chance to fight him, to take him on. Discussion goes too fast. Need a tape recorder--a mix of Magna Carta, Declaration of Independence [not raised yet], constitution, Nixon, etc.)

Why no longer have a right to rebel?

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[38] A reference to an agenda of broader teaching skills on the observer's mind.

[39] Another social studies teacher who had been observed earlier.

(Obs - One boy keeps pushing and teacher keeps fighting. The teacher's cantankerous approach is so much in his general personality; same thing he was doing to me, he does to kids. They aren't sophisticated enough to win.)

Later, as one of the students made a point about "limited orderly rebellion" and another, "might makes right," and the discussion on the point moves toward closure, the teacher comments, "Fascinating." The observer notes (Obs - He backs off). And one of the kids gets in a last lick, "Don't you ever answer your questions?"; and the teacher, not to be bested, comments, "No, they're too difficult."

So the hour went. It was exciting. It was stimulating. How other days go is not clear. The teacher commented that the kids bounce back and come at him again and again. He perceives them learning independent critical thought. Other teachers comment that they hear favorable things from the kids.[40] The major antecedent, as the teacher reports it, was an esteemed professor he worked with at the university.

Summary

These vignettes are but a few instances of interesting lessons, teaching, and teachers. The array of instances that might have been presented leaves the observer/analyst feeling he has slighted dozen of others. It even raised another alternative to the present report--a compendium of classroom protocols with minimal comment--more in the tradition of Terkel's Working, perhaps just called Teaching Science. The reader would be left to his own conceptualizations and interpretations, his own judgments and evaluations. In this way we could have captured a beautiful concept development lesson on force, mass, weight, and vectors. We could have seen the nuances of telling illustrations interwoven into dialogue and into clever questioning, of careful preparation over the years, which has tightened all the instrumentalities toward clear and specific goals. Or another teacher clarifying Mendelian genetics, phenotypes, genotypes, heterozygous, and homozygous to which the observer made an aside.

(Obs - He has a soft gentle way with the kids, jokes a bit, e.g., "red-eyed males," keeps after the kids for answers, kids are attentive.)

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[40] The kind of data needed to explore and tie down carefully the implicit propositions regarding antecedents and consequences of such a teaching style would be a project in itself.

And thirty minutes later in the same class:

> (Obs - I'm struck by the kids who are part of the silent majority, good kids, not especially academic, teacher helpful, easy going moves around the room, class is small enough that he can get around and attend to each youngster. He does.).

Then, there was a math teacher laden with an armful of papers and books (the math office is some distance away and inconveniently located) who was teaching advanced math to a group of seniors, many of whom were in a physics class the observer had visited a few weeks before. They were "feeling good" here, as they had been feeling also in science. The math teacher fed this feeling with a story of a teacher rigging participation with a class for the benefit of a supervisor. Everyone was to wave a hand at every question. Those who knew the answer were to raise their right hand, those who did not, their left hand. That way everyone was a winner. Then they started on math. "Any problems giving you difficulty?" The students would read a problem from their homework. The teacher would write on the board, pace about, engage them in math and byplay as he broke the problem apart and teased out the difficult component. To his "How come when I do them they come out?" he got a retort, "Why don't you take our tests?" As the give and take continued and as they worked their way through problem 11, in Dolciani's text Introductory Modern Analysis, the observer commented in the notes:

> (Obs - He kind of engages in a three-way jousting--him, them, and the problem. All good fun.[41] Kind of--why aren't you as good as me?).

Then they hit a problem involving graphs, rotated angles, slopes, tangents, sines and cosines. The teacher worked it out, commented "Hard to know what they mean?" checked out the answer key, found a different answer there, reworked the problem the other way, got the answer. The observer was dazzled and commented in the notes:

> (Obs - The jousting then becomes a four-way--me, you, the problem, and the text's author).

The teacher finished up with, "Enough of that. I won't ask you anything as hard as that," and moved on.

Then there were junior high social studies classes with simulation activities--a continent with countries resembling Europe pre World War I, and social studies with an impromptu elaboration

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[41] Earlier (Smith and Geoffrey 1968) we called this banter. In Alte we found many sophisticated users of that mode of interaction.

of the concept of democracy to a youngster's confusion re "democratic" both as party and/or derivative of democracy. And an elementary science lesson using a kit from ESS; in a room with a sewing machine used for the geometry of patchwork quilts; and social studies, in part taught with a unit of free enterprise economics in which the kids built wooden flowerpot holders for profit; and some more of science taught out of doors in field trips. And then there was the conversation with an extremely able and creative sixth-grade pupil on a social studies field trip to the city hall where the youngster commented about liking a Rolls Royce we passed by.[42] The observer asked him if he'd ever heard of Thorstein Veblen. He said no. The observer teased him that he was a victim of "conspicuous consumption." He looked perplexed. His teacher joined in with a, "You can figure that one out." And he did. And we played Torrance vs. Getzels and Jackson for a while as we toured City Hall, with an unfortunately bland and uninformed tour guide.

This, then, is curriculum as what is taught: vignettes of science teaching in Alte.

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[42]Several weeks earlier, the observer had sat next to him in a Databank lesson and listened to and been impressed with his sotto voce monologue and also had been around as he pleasantly tried to "con" the IPI teacher aide in the LRC. The observer had visions of an off shoot case study of a highly creative youngster coping with mostly a highly convergent curriculum. Maybe next time?

Aspects of Curriculum-as-What-is-Taught: Latent Patterns

Each of the vignettes of teachers and teaching carries particular images. While the reader can make his own interpretations and judgment, the observer/analyst looked for patterns that would interrelate these discrete images with other particular images and other aspects of science education in the district. This involved us in a search for patterns and some provisional conceptual order in the wealth of diversity exemplified in the vignettes. The analysis highlights Alte's concept of the "strong teacher," the percentage of good/strong teachers, the centrality of the teacher in the classroom and "staleness" as another point on the continuum.

The "Strong" Teacher

Early on in the district we kept running into the expressions, "strong teachers" and "good teachers," occasionally appellations of prima donna. More rarely, "weak teachers" or "mediocre teachers" were mentioned. The conception seemed to be district-wide--teachers referring to their colleagues, administrators speaking of the staff within and across buildings, parents and school board members commenting on science education. Pupils used the simpler good-bad labels on occasion, or more colloquial, "she's great," "she's nice" references. Within the district there's more than a fair amount of agreement on what this means. Almost universally, the following are included:

1. a deep and abiding knowledge and interest in the subject matter (especially true for junior and senior high teachers);
2. knowing what they want to do with the subject matter with kids at the age/grade level they are teaching;
3. being "turned on," motivated, interested in their field;
4. conveying, stimulating, engaging the children in this set of learning, thinking, motivational processes; and
5. multi-dimensional aspects of personality and background--"second suits" of strength.

In brief, the norm seems to be, "What can you do educationally with kids." As one teacher expressed it about another teacher, "He's a hard act to follow."

Evidence for such a conception comes from a number of sources and observations. The system hires for this, supervises toward it, evaluates in terms of it, and ultimately relates to the citizenry in terms of it. Briefly, the hiring process involves an initial screening of applicants' paper credentials and a long series of interviews. The final applicants are then observed in their teaching if they are from a nearby district or teach a group of

Alte children if they are from out of town. The paper credentials give an immediate overview of the kind of institution, patterns of coursework, level of attainment (e.g., with honors).[43] The interviews permit an assessment of articulations in general and in terms of subject matter to be taught. They permit an assessment of the teacher's perspective, e.g., "What do you want/try to do with kids at this age level in this course, in this setting?" They permit a wider view of the personal and intellectual resources of the applicants, e.g., "What else do you enjoy doing with kids?" The observation of teaching, usually by two or three staff, permits an assessment of whether the teacher can put it all together with a group of youngsters. Here particularly, the search committee looks to the reactions and comments of the children in the class, the teacher's enthusiasm and his/her style.

A similar view can be seen regarding teacher evaluation in a document entitled Professional Evaluation, produced within the last year by a committee of teachers and administrators of the Alte School District. The document sketches out "expectancies" for "professional educators." Four models of assessment are included: supervisory, collegial, client, and a combination. Procedurally they are quite explicit. For instance, the supervisory model calls for a pre-evaluation conference, goal setting conference, classroom visitations (at least three), post classroom conference (after each visit) and a final evaluation conference and report. Items discussed in conference are grouped into goals, strengths, and weaknesses; items observed include broad categories of teacher as a professional, classroom atmosphere, and interacting with people. Each of these divides into a half dozen or more components. As staff talk of the system as it is beginning to be used, one gains the impression that there is both clarity and potency in the evaluation attempts. One of the most intriguing aspects is the implicit quality of "this is the kind of system we want, the kind of people who should staff it, the kind of teaching and learning that should be going on" and "these are the ways we are going to achieve it."

As the observer met the teachers--in groups and one by one--he was forming his own perceptions. These coalesced into two interrelated clusters which came to be called "three dimensional teachers" and "career professionals." The former refers to the simple observation/judgment that they were interesting people to be around and to talk to.[44] In the notes, the observer made comments of the order

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[43] Brief accounts of new teachers appear in the Alte News each year. Vita items such as these are part of the "description" of the newly hired teachers.

[44] Earlier, on another occasion, Professor Harry Broudy of the University of Illinois has talked with the observer of a similar idea which he called the aesthetic dimension of personality, the novel, the interesting, the dramatic aspects. Its potency, while unexplored in detail, has remained.

"Other extreme from most of the teachers described by McPherson in Small Town Teacher" and "Conversations sparkle with references to contemporary music, discussions of language and national character, relations of verb forms in Latin and early French, and such varied activities as gardening, weaving, scuba diving." Another example was the fact that people into outdoor education included administrators, shop teachers, language and math teachers, aides and secretaries. As indicated elsewhere, this brought striking resources into that part of the curricula. Overall the observer's reaction was that the staff was a distant cry from the stereotype of the dull, uninteresting image of "those who can't do, teach." Not only did most teach very well, but they also did a number of interesting things besides.

The "career/professional" category arose from a number of particulars. In one of the first interviews with a principal, a chance observation and an intentional comment were made by the observer about two books, Homans' Human Group and Webb, et al's Unobtrusive Measures. The principal replied that he had studied, worked, and published with several of the major figures in the "social science approach to administration" in other parts of the country. He was one of several perceptive theoretically sophisticated administrator practitioners the observer encountered. It seemed as though everyone the observer met had an M.A. (actually the figures are 75 to 80%) and that every other one either had a doctorate, had everything but the dissertation finished, or was in the throes of course work.[45] A number of the faculty teach part time in local colleges and universities. These assignments vary across methods courses and substantive courses in their disciplines. The sabbatical activities include research positions in industry and in university laboratories, different teaching assignments, and curriculum development work, as well as further professional training and advanced degrees. Scanning of the Alte School News indicates a number have won local and state awards as "Outstanding Science Teacher of the Year." Many have been involved over the years in national organizations, e.g., taking and/or teaching in NSF Institutes, and consulting on college board committees and examination writing and scoring. Finally, a number have developed their own course materials, outlines, laboratory experiences; a few of these to the point of commercial publication as textbooks, filmstrips, curriculum units. In short, as a group they are busy, active, career oriented professional teachers.

The twin phenomena of "three dimensional personalities" and "career professionalism" come together in what might be an "overlap of

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[45] The exact figures were not obtained. All the administrators (but one) do fit the category. Several of the "science educators" have completed their degrees and are addressed by pupils as "Dr. ____."

abiding life interests and teaching." Figure 19 indicates some of the elements in the conception and in antecedents and consequences.

Insert Figure 19 about here

The conceptions are barely developed, quite hypothetical but consistent with the data and the overall impressions of science education in Alte. As social studies teachers do oral history inquiry, as science teachers work as park rangers and pursue avocations of bird watching, rock hounding, or photography, they bring interrelated activities to their teaching.

Some years ago, in synthesizing several studies toward a general point of view in teacher education, we sketched a several strand model of "phases and emphases" in the development of a professional teacher. That is reproduced here as Figure 20.

Insert Figure 20 about here

These comments were made about the strand on idiosyncratic styles of teaching.

> The idiosyncratic styles of teaching, which we have not emphasized explicitly but which we hope are implicit throughout this paper, would be in gradual development from the first experiences in teaching and should continue to blossom long into one's career as new emphases in curriculum, in instructional processes, and in the psychological and social foundations arise on the broader scene and as one builds them into or reformulates one's practices. In a fundamental sense the artistry of teaching should be a major focus and satisfaction in the profession of teaching. In our research we obviously do not have direct data on this from our dozen apprentices. More indirectly, the cooperating teachers seemed quite varied in this regard, although our data are not good in that we did not observe them teach to any great extent. Further examination of idiosyncracy as a means and as an objective in a psychology of teaching seems very important.
>
> (1972, p. 161)

In a sense, it seemed as though we were waiting for a setting such as the Alte Schools and its cadre of "strong teachers" and "living legends." Our vignettes have carried forward the descriptions. The analyses, while remaining mostly implicit, should suggest the exciting possibilities.

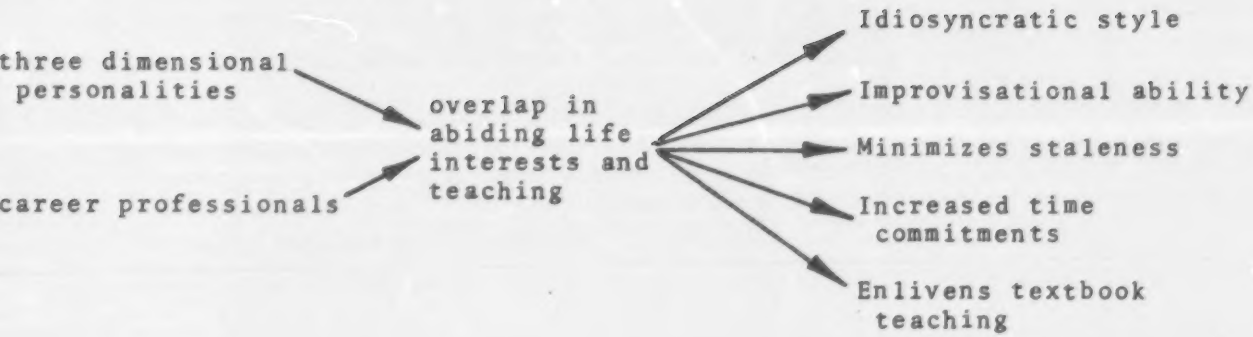

Figure 19. Implications of life interests and teaching

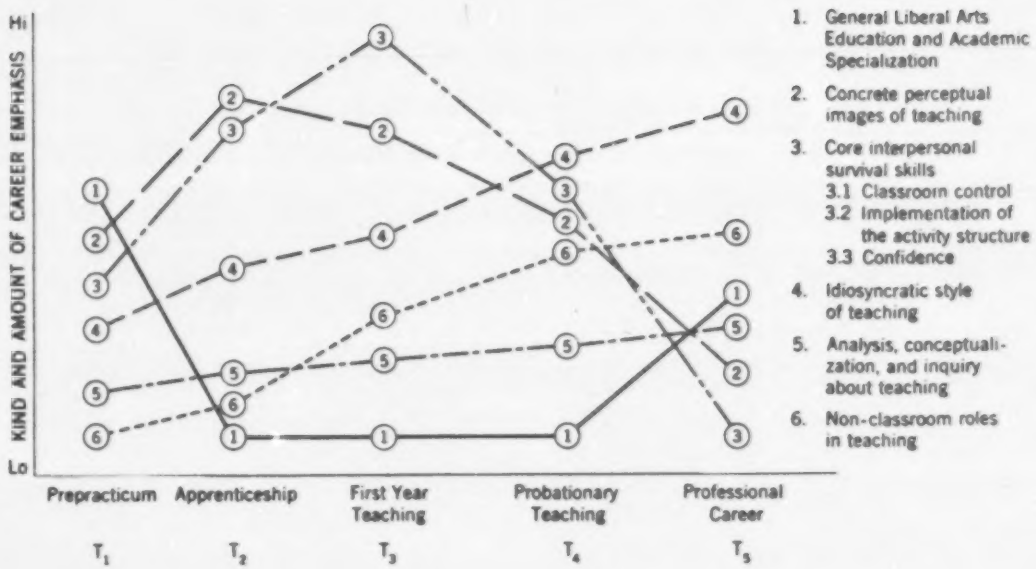

Figure 20. A Preliminary Model of Phases and Emphases in Developing a Professional Teacher (from Smith 1972, p. 160)

But, winds blow for both good and ill, if our data can be believed. One of the core elements of being a living legend is professional visibility. And with professional visibility comes a number of consequences: we have tried to capture those in Figure 21. The data come from conversations with teachers,

Insert Figure 21 about here

administrators, and parents. The consequences include items such as esteem from students and parents, social rank in the faculty, and competitiveness in the faculty. These, in turn, engender power and influence which can be used for all kinds of purposes. All this may be good or bad, depending on who you are and where you stand as fellow teacher or administrator.

After a long interview with one of the teachers, who is commented upon by everyone as one of the best of the Alte staff, but who was recalling some of his class efforts, further insight into the negative aspects of the teaching situation arose. In the summary observations and interpretations, the observer caught it this way.

> In thinking about the situation stated by the teacher, it seems to me that one of the things that remains is the notion of the need to build in, both administratively and with one's peers, the kind of reward and reinforcement and acclaim that comes with doing a good job. Somehow that didn't seem to come for him from anyone. That left him with a very strong, unhappy, disappointed feeling. As he said, "I went into a depression for six months." Somehow, that seems to me to be a potent statement on the nature of things.
>
> One of the problems of systems that are composed of "stars," highly individualistic, competitive types of individuals, is that there isn't the sense of community that builds in the kinds of things that typically give those sorts of rewards and reinforcements. And that might well be a dysfunction of the type of system we've been talking about. It seems to me that that runs through some of the departments and between levels of schools in the district. It seems to me that there is enough of that kind of dissatisfaction that I've run into from several others to make it a reality.

The host of related issues that need to be synthesized here await another time, project, and data.

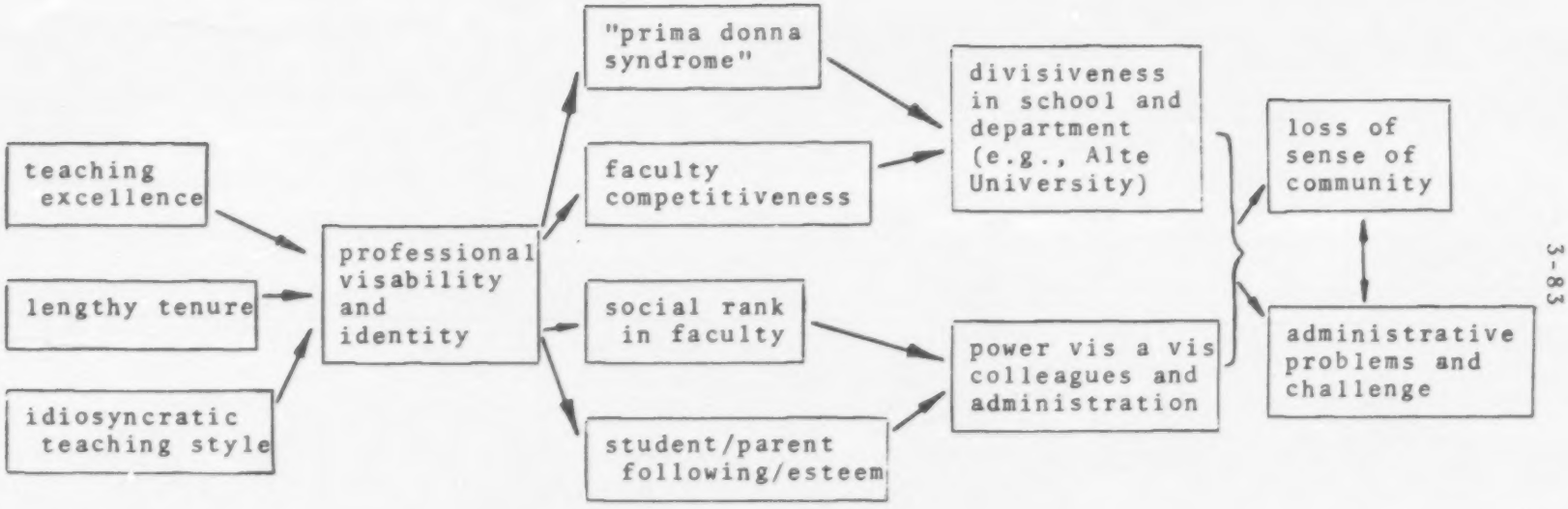

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Figure 21. Antecedents and Consequences of Professional Visibility and and Identity

Staleness: Another Point on the Teaching Continuum

Most of the excerpts of teaching that have been presented carry positive connotations--at least in the eyes and values of this observer. Not all the teaching was of this order. In some of the early observing, a sense of particulars coalesced into a pattern labeled--"teachers who have gone stale." The mix was a flatness, a lack of vitality (physically, personally, and interpersonally), a seeming lack of interest in the curriculum (science, math, or social studies) by both the teacher and the children, a lack of creativity and curricular risk taking, a negativism toward the children--they're spoiled, they don't care, they don't try--and sometimes a negativism toward colleagues, administrators, and college and university training programs (often decades ago). Age seemed a correlate; gender did not.

After this had been identified tentatively, it was explored in the latter part of a number of the exit interviews with teachers, administrators, board members, and citizens. Invariably, "it blew the interviews wide open"; that is, the interviewees agreed that the phenomenon (or their own conceptualization of it) existed, that it was the problem in the district generally. Some of the individuals went on to explore the issue for upwards of an hour. Some would have continued longer but for other appointments and classes and the amount of time we had already spent.

The major ideas that developed were these:

1. It was not just a problem in science education.
2. Some saw it as not a problem of "going stale," but a problem of some teachers who were "average/adequate" but not "good/excellent" from the start. Most interviewees eventually came down on the tenability of both hypotheses.
3. Most argued that Alte had many fewer teachers in in this category than other school districts, both absolutely and in terms of percentages.
4. Many talked in detail of Alte's complex approach as to resolving the problems at both the level of the individual schools and at the level of the district. These approaches were felt by them to be the most comprehensive and sophisticated in the metropolitan area.

As an issue, it led the observer/analyst into a wide range of additional phenomena, events, and interpretations. As with each of the other major sections of the project, it tended to tug at an observer's time and interest and threatened to become the thesis of a redefined project. Keeping it in the perspective of "Science Education in the Alte Schools" became difficult, indeed. Hypothesized antecedents and consequences appear in Figure 22.

Insert Figure 22 about here

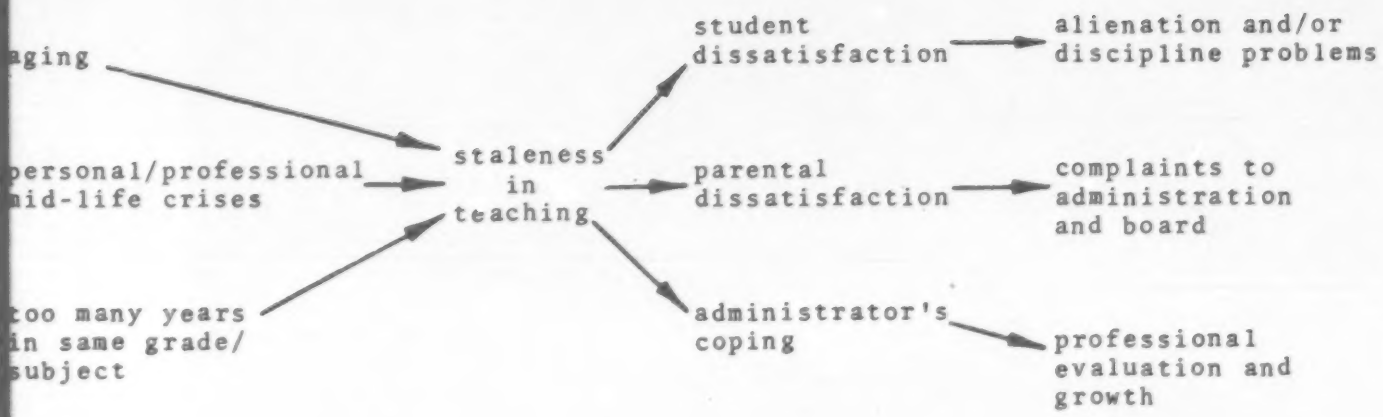

Figure 22. A Miniature Theory of "Teacher Staleness"

Analytically, a key issue became, "What can a district do to avoid or remediate the going stale phenomenon?" As the observer was speculating on this, he discovered in the Alte School News, a report of "The Committee to Stimulate Excellence in Teaching," a set of proposals for general staff growth and development. The board of education voted $10,000 to help carry forward the recommendations on mini conference grants, individual career planning grants, cash subsidies to the Alternative High School Program, and "the installation of telephones for teachers in all the district buildings."[46] Figure 23 contains hypotheses regarding the prevention/remediation of staleness which arose in conversations and reflections.

Insert Figure 23 about here

Percentage of Good Teachers

Very early in discussions with parents, administrators, or teachers, no matter how much one tried to talk of general dimensions of science education in the Alte Schools, the conversation would eventually turn to the capabilities and competence of the individual teacher. Characteristically, the thought processes of the parent would come back to a particularly "strong" or "weak" teacher their son or daughter had had in this grade or that in the elementary school. Similarly, departments in the junior and senior high schools would be described in terms of the percentage of strong and weak teachers. Contrasts and comparisons would be drawn by teachers and administrators between Alte and districts in which they had previously worked. Invariably, Alte would come out ahead. No one would speak of teachers who were "really bad" or "shouldn't be in the classroom" as was Miss X or Mr. Y from Blank District whom they'd taught next to before they came to Alte. Usually such individuals in those districts were described as not knowing what they were supposed to teach (e.g., an ex businessman who didn't know math or science content) or who were hostile or vicious in interpersonal relations with the children. At worst in Alte were a few "average" or "mediocre" teachers, in the judgment of most commentators.

For our purposes here, the point is similar to that made about the other dimensions. If science education in a district is to be described and analyzed in a way rich enough and mundane enough to

[46] This item came up in conversation after conversation with teachers at all levels. It was/is perceived as a major facilitator of the teachers' efforts--especially with home contacts. As the observer was around offices and faculty rooms, the phone seemed in constant use.

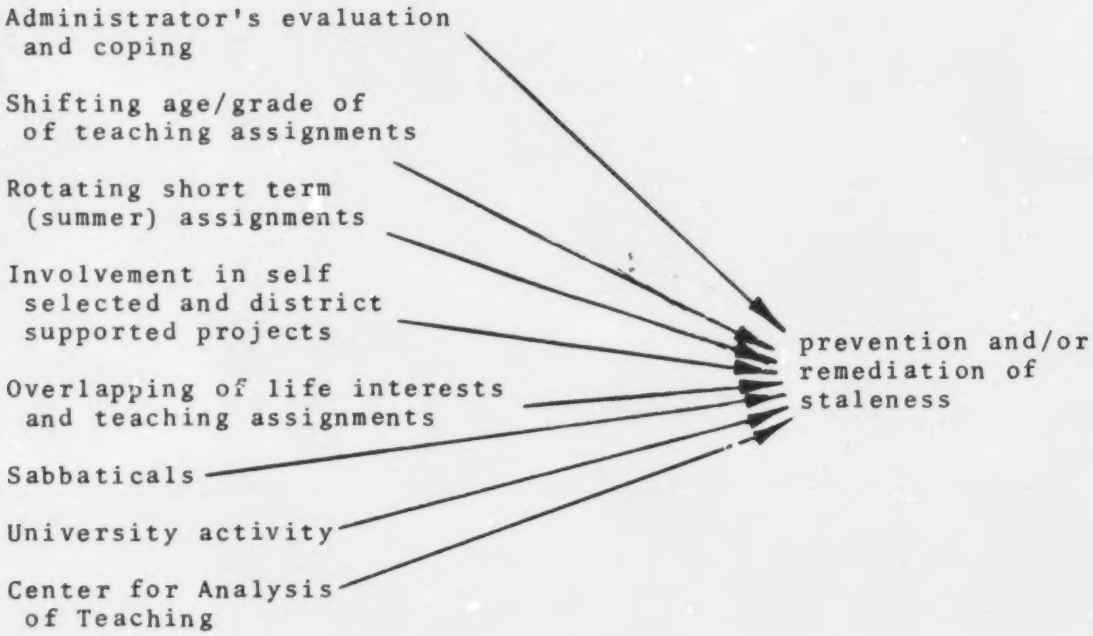
Administrator's evaluation and coping
Shifting age/grade of of teaching assignments
Rotating short term (summer) assignments
Involvement in self selected and district supported projects
Overlapping of life interests and teaching assignments
Sabbaticals
University activity
Center for Analysis of Teaching
prevention and/or remediation of staleness

Figure 23. Preventing and Remediating Staleness

deal with the way participants in the system construe the system, an assessment of something like "the percentage of good teachers in the system" must be made. If we take our proverbial fifty school districts, does Alte have a higher percentage of good teachers than any other district, about as many as the middling district or fewer than most of the fifty districts?

Illustrative of local attempts to do this is the survey, How Citizens View the Alte Schools, cited earlier. Parents were probed:

> Based on what you know, how far up the ladder or how far down the ladder would you rate the job being done by teachers in the public schools?

The citizens with children in the schools responded: Excellent 31%, Above Average 50%, Average 15%, Below Average 2%, Poor 1%, and No Opinion 1%.

From this observer's perspective (Smith 1977), teacher effectiveness or teacher competence is "a complex valuational/theoretical / empirical judgment." Unless the problem is approached at that level (and not just as a value-free technical problem), it won't be solved. Alte seems to have made a major start in a congruent direction. Of all the "dimensions of science education" discussed in the Alte School District, the "percentage of good teachers" is the most critical one.[47] The assessment and enhancement of that dimension are tasks engaging personnel at all levels in all parts of the district.

Balance/Diversity in Staff

For a number of years, we have been enamoured with the concept of balance/diversity in a school staff. The concept refers to the kind of variety represented in our half dozen vignettes. Presumably, a series of observations/interviews/documents could be used to assess individual teachers in the science education program of fifty schools and judgments could be made regarding the degree of balance/diversity that exists in each school district relative to other districts. At that point, antecedents and consequences could be tested. In Figure 24, we present a miniature theory, a series of interlocked hypotheses, suggested by our data. The degree

Insert Figure 24 about here

to which they are true in the broader educational world is open to question and empirical test. That they reflect important issues in the theory and practice of science education seems obvious.

[47]As mentioned earlier, Alte does not have problems of economic resources, juvenile violence, or racial conflict.

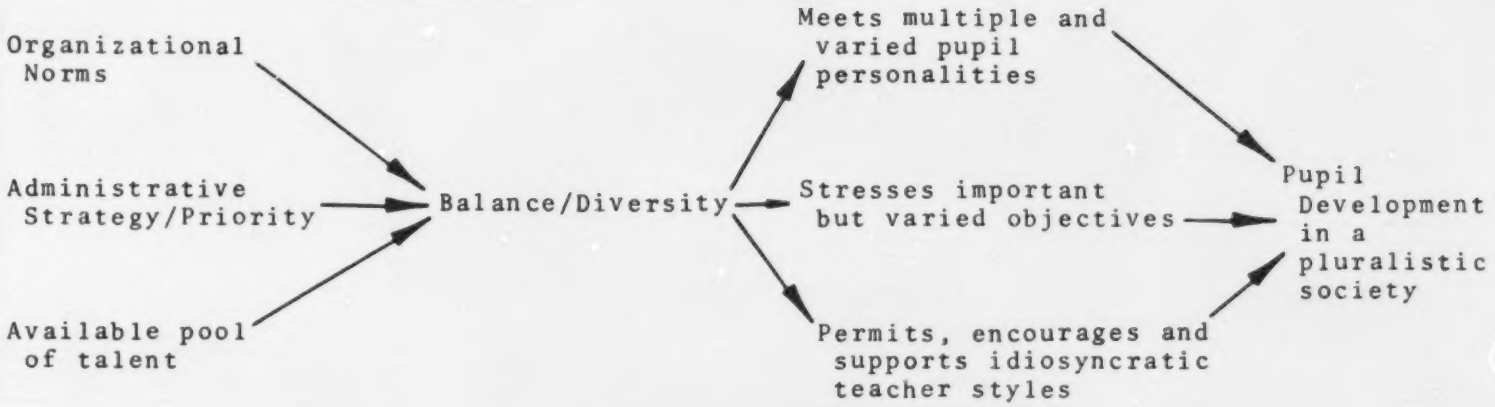
Organizational Norms
Administrative Strategy/Priority
Available pool of talent
Balance/Diversity
Meets multiple and varied pupil personalities
Stresses important but varied objectives
Permits, encourages and supports idiosyncratic teacher styles
Pupil Development in a pluralistic society

Figure 24. Antecedents and Consequences of Staff Balance/Diversity

Centrality of the Teacher in the Classroom

On occasion in observational studies, the presence and recurrence of little items jell into patterns and conceptions of larger significance. Consider, for instance, the presence and recurrence of these items across schools, levels, disciplines, and departments:

1. in most classrooms, a section of the blackboard with assignments for each day of the week;
2. teachers' grade books literally full, cell by cell, of pages of numbers;
3. teachers carrying a stack of laboratory notebooks home to be graded (in the evening) or into class to be returned (in the early morning before school);
4. lab books full of red ink comments;
5. frequent classroom byplay around the question, "Does it count?";
6. reviews before tests, taking of quizzes and tests, returning and checking of tests;
7. in the staff room of one school, the presence of a small test scoring machine for rapid marking of objective tests;
8. long faculty discussions and memos defining "cuts" and "absences," clarifying responsibility among teachers, administrators and clerks; and
9. sitting in offices and staff rooms as teachers talk in detail with parents re a child's work, both its quantity and quality.

Several lines of meaning seem implicit in these items:

1. the teachers play a dominant and influential role in pupil learning;
2. students are expected to learn, assignments are made, products (homework, lab books, tests) are monitored carefully; and
3. points accumulate into semester grades and grades into class ranks.

Further, there is more than a fair congruency in these items and their presumed meanings with (1) the conception of the "good" or "strong" teacher in Alte, and (2) the district-wide conception of excellence in teaching, and (3) the administrative and organizational means of reaching excellence.

Finally and perhaps most importantly, the items can be placed up against two more general positions in the literature. First, in a classical review of classroom questioning, Hoetker and Ahlbrand conclude regarding "the persistence of the recitation":

> The studies that have been reviewed show a remarkable stability of classroom verbal behavior patterns over the last half century, despite the fact that each successive generation of educational thinkers, no matter

> how else they differed, has condemned the rapid-fire, question-answer pattern of instruction. This opens a number of interesting avenues of inquiry. What is there about the recitation, for instance, that makes it so singularly successful in the evolutionary struggle with other, more highly recommended, methods? That is, what survival needs of teachers are met uniquely by the recitation?
>
> Then there is the question of what seems to be the monumental inefficacy of teacher training institutions in affecting the classroom behavior of teachers. If the recitation is a poor pedagogical method, as most teacher educators long have believed, why have they not been able to deter teachers from using it?
>
> Or, is it not possible that the practicing teachers are right, and the professors unrealistic, and that the recitation--for some reason--is the best pedagogical method? Or the only practicable one for most teachers?
>
> (1969, p. 163)

A most interesting set of questions!

Secondly, there were some deja vu aspects of these elements in teaching. Items from an earlier study, The Complexities of an Urban Classroom (Smith and Geoffrey 1968), kept reappearing. Miniature theories of homework and textbook teaching from that study are presented as Figures 25 and 26.

Insert Figures 25 and 26 about here

The point that is being made is that textbooks and homework abound in Alte and have an array of functions--and some dysfunctions--which Hoetker and Ahlbrand hint at and Smith and Geoffrey hypothesized about.[48] While a lengthy comparison of each element would be necessary, suffice it to say (1) that the "negative consequences" seem less frequent in Alte; and (2) that both texts and homework are embedded in a broader and richer program, as the vignettes and earlier analysis indicate, than the classes in the Washington School. Many of the functions exist nonetheless.

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[48] If we had been onto this issue earlier and if we had had more time, the Smith-Geoffrey models would have made beautiful vehicles for more systematic interviewing.

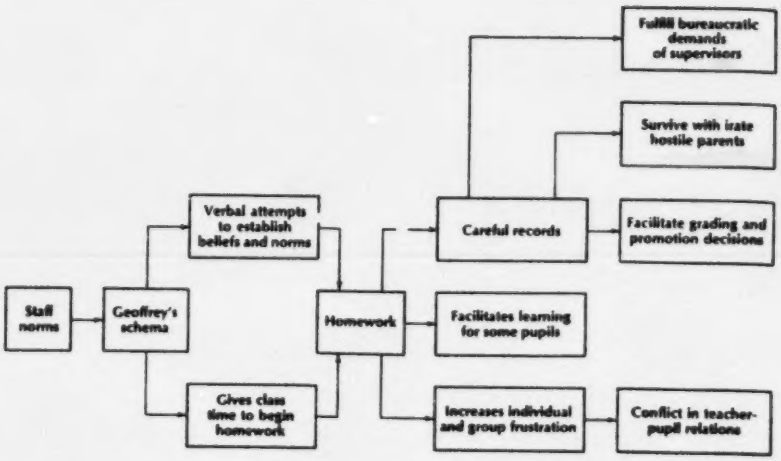

Fulfill bureaucratic demands of supervisors
Survive with irate hostile parents
Verbal attempts to establish beliefs and norms
Careful records
Facilitate grading and promotion decisions
Staff norms
Geoffrey's schema
Homework
Facilitates learning for some pupils
Gives class time to begin homework
Increases individual and group frustration
Conflict in teacher-pupil relations

Figure 25. Ramifications of Homework as an Activity (from Smith and Geoffrey 1968, p. 182)

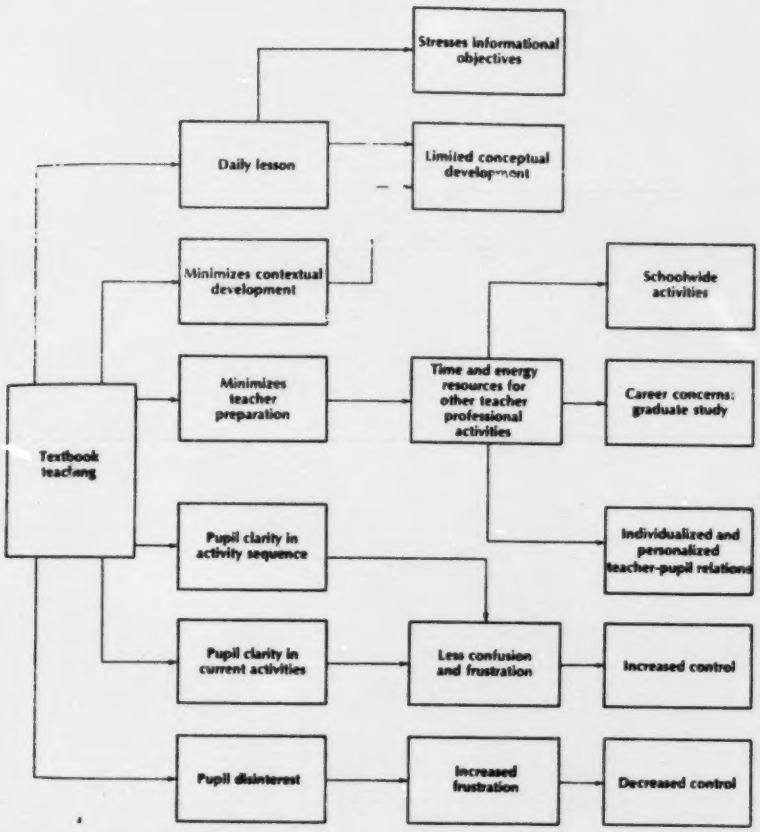


Figure 26. Impact of Textbook Teaching on Aspects of Classroom and School Social Structure and Processes (From Smith and Geoffrey 1968, p. 183)

The accumulating observations and the accumulating interpretative asides suggest a beginning toward an accumulating analysis.

> (Obs - So far, in junior and senior high, most of the math has been text, high demand, digging into it.)

And

> (Obs - Again, if the text is well written, and if the kids plow through it, and if they are bright, much of the outcome will be there. Assume you may lose a little of the specifics, a bit more of the generality and transfer, and a gradual dropping out of interest in math by a couple more kids.)

That this kind of analysis into teaching can be carried further appeared throughout the notes. For instance, in a junior high math class:

> The pupils are all busy on text problems, working independently. She goes to those with questions. Comments. Helps.
>
> (Obs - Teaching in motion
> personalized interaction
> overcoming specific barriers to learning.)

All of which are major concepts from the earlier study (Smith and Geoffrey, 1968) whose subtitle was "toward a general theory of teaching."

In the course of the semester we collected a number of "tests" used in different parts of the curriculum. More systematic accounting of what the pupils are expected to know would have tied down the intellectual substance of science education. We have excerpted into Figure 27 a few items which capture the flavor of some of those expectations. Some are "fun," some involve intellectual

---

Insert Figure 27 about here

---

skills, some tap developing concepts and some pull quite specific information. All seem tied to the broad goal of academic excellence.

In short, the teachers are central figures in science education at Alte. One might say that Rousseau doesn't live here. The teachers play a vigorous role in classroom interaction. Many are skilled artistic performers. They make strong and high academic demands on the youngsters. Even in a heavily lab-oriented, hands-on experience, the work is guided by textbooks and materials (some of which were written by the Alte staff), implemented through homework of quite varied but demanding sorts, judged in frequent and assorted tests and examinations.

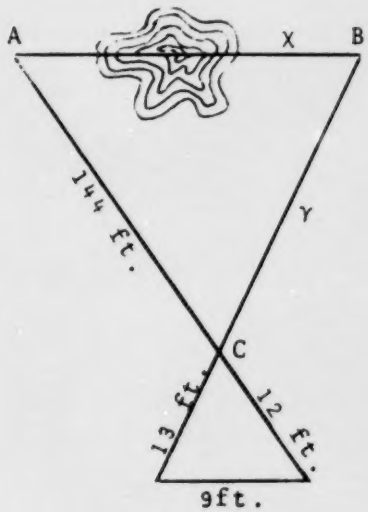
Quantitative Science

1. What is the force with which a three gram cookie strikes a wall while accelerating at a rate of 6 cm/second per second?

2a. What is the weight of a caterpillar as it accelerates at a rate of 4.5 centimeters per second per second along the trail in Olympia National Park. The mass of the caterpillar is 50 grams.

2b. What force would it take to accelerate the caterpillar over a carpet of bryophytes (moss) at a rate of 2.3 ft/sec/sec?

Junior High Math



A bridge will be built from A to B.

1 Solve this proportion to find its length.

$\frac{X}{9} = \frac{144}{12}$ X = _____ feet

2 Complete and solve this proportion to find the distance from B to C.

$\frac{Y}{13}$ = _____ Y = _____ feet

Figure 27. On Being Tested in Alte

A Center for the Analysis of Teaching:
A Community Resource

This long account of teaching--its excitements and its problems--leaves one with questions of implications and recommendations. After many hours of observing and talking with teachers and many hours of talking with administrators, parents, board members, and university colleagues, many of the ideas coalesced into what might be called a Center for the Analysis of Teaching. The idea is intended to be neither presumptuous nor patronizing. Actually it grows out of several concerns, perhaps the most basic that much of the university's contribution to the public schools is limited and ineffectual.[49] The idea comes, in part, from teachers who have reputations as being "strong teachers," as revealed in such simple comments as "I need to get out of my rut," to the more complex "I was in a depression for six months after that 'educational' experience." They seem to be looking for kinds of resources and experiences that are rarely provided for in public schools, even those as well endowed as Alte.

And finally, the idea springs from the questions of administrators and citizens: "What do you do with a Miss X or Mr. Y who has lost interest, lost touch with the subject and/or the kids, who is just putting in his/her time?" As they talk about their efforts to overcome what we have called staleness, they have been stymied, even in a metropolitan area that boasts a half dozen institutions of higher education and an array of other cultural and intellectual resources.

The initial structure and agenda of such a Center would follow from a combination of a relatively simple set of assumptions and a statement of the manifest and latent issues and observations in Alte. First the assumptions:

1. It would be an organizational instance of what Atkin (1972) has called "practice based inquiry." While it would be a service-oriented facility, it would have a commitment to this blend of clinical research.
2. It would be attached to or located within a university.
3. It would begin small to see if it could make demonstrable contributions to individual teachers, schools, and districts.

The initial agenda follows simply upon the major parts of this analysis:

1. In-depth investigation of teaching styles we have described earlier. Bringing to bear intensive qualitative observation,

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[49]At one level this can be taken as a personal view of one observer/analyst in a particular education department of a particular university. The degree to which anyone else believes the same is an empirical issue.

intensive interviews, careful video recording of long sequences of classroom interaction toward an analysis of learnable/teachable aspects. In a sense, doing for teaching what Bloom and Broder (1951) initiated in problem solving.

2. Becoming a referral source for "teachers with teaching problems." In effect, providing a back-up facility for both diagnosis and retraining, patterned in part after the supervisory model of evaluation but with the resources to carry out more intensive long-term analysis and training. Some of this might be handled in a course on the analysis of teaching. Mostly, the impact would come from an "individualized case approach." Once again, I'm reminded of psycho-educational clinics working with children with reading or arithmetic problems or medical clinics working with specialized medical problems. In part, the clientele would be self-referrals; in part, school or district referrals.

3. Short term individualized analysis, discussion, and change in teaching. In every school, the observer ran into teachers who wanted to "talk teaching." By this is meant they wanted to show him something they did (which often was well done), have him react to it, argue about it in the best sense of exploring its latent nature and implications. Again, from the observer's point of view one of the most frustrating parts of the research was the continuous pull to spend long periods of time in classes of individual teachers, engage in lengthy "interview/discussions," attempt to understand them, their situation, their theory of teaching, both espoused and in use. The observer wanted to establish relationships of the order of those he had made on other occasions, e.g., Smith and Geoffrey (1968), Smith and Brock (1970, in press).

4. For those teachers whose content knowledge has become dated or whose teaching assignment has shifted substantially, and who have the possibility of extended summer work or a semester or year sabbatical, the tailoring of a more formal program of study. Our observations of several instances of this suggest that in a district such as Alte it's not so simple an event as a course here or there. Each of the schools has its own ethos, its own context. Retooling in elementary math or social studies, for instance, may require work in the teaching of reading because reading is the sine qua non of success in the elementary school. Similarly, changes in high school science or social studies may be implicitly but fundamentally linked with mathematics or literature or history. A Center for the Analysis of Teaching would have to have resource alternatives to expedite major program planning within and across disciplines.

5. One teacher, in thinking about the issue, outlined a brief proposal. It is reproduced verbatim.

TEACHER-LEARNER: A Proposal for NSF for a "New Kind of Sabbatical"

I. The teacher would serve as a teacher for the academic year within the district but carry only half the teaching load. The other half of his/her time would be spent in an academic pursuit as described in the projects listed below and the projects would be run in cooperation with a university.

The NSF would pay the district the amount of one half of the teacher's salary and absorb the university cost and supply a consultant for each project who would make at least two site visits. The NSF would publish annually the final reports of all projects.

II. The projects would involve the teacher--the district--a university--and the NSF. All projects would be initiated by the teacher except F as listed below. The application would be submitted by the teacher and district jointly.

III. Types of Projects.

A. Writing new curricular materials
B. Implementing a new curriculum
C. Writing a research paper on a particular topic
D. Investigating and applying learning theories
E. Executing an educational research experiment
F. Apprenticing to a master teacher (This one would be initiated by the district in an effort to help a teacher improve his style. No district could apply for this until it had had one of the above.)
G. Retrain

IV. University involvement

The teacher is too often isolated within the classroom, and this proposal addresses itself to this problem in two ways. Hence, an integral part of the proposal is the involvement of an individual or team from a college or university who would work with the teacher in defining the problem, executing and writing the report. The teacher would be given free access to libraries, herberium, etc.

V. Special considerations for rural teachers

A. Travel allowance to a university
B. Reduce class load by only two classes, but free one day per week for travel to the university

VI. NSF Consultant

The consultant is a helper who will visit the site at least twice and serve the following functions:

A. Active, sympathetic listener
B. Expediter to handle red tape in NSF/district/university
C. Resource person, such as getting copies of documents from L of C, or providing references of similar projects, etc.
D. Editor

In summary, the observer was immensely impressed with the idiosyncratic styles of teaching exhibited by a large number of Alte's teachers. He was privy to the concerns voiced by others--some of which were major professional life crises. In some instances, he observed teachers who he felt, and others corroborated, had gone stale or burned out. In perhaps too quick an extrapolation, it seemed that organizations such as NSF and the universities might make more of a contribution than they have to those issues. A Center for the Analysis of Teaching is one simple thought in that direction. Several Alte teachers agreed.

AREAS OF CONTROVERSY

Within the Alte Schools several areas of major controversy exist. Mostly they impinge upon "science education" rather than being central to it; consequently, the discussion here will be brief. IPI math, Individually Prescribed Instruction in elementary mathematics, is the curricular issue most in contention in science education. That has been considered at length already. Several other issues are worthy of mention: teaching average ability youngsters, "the silent majority" as it is sometimes called in Alte, and the "A School," the alternative high school. Finally, there are some interesting differences of opinion regarding resources.

Teaching the "Silent Majority"

In a college prep high school where 90% of the students go to college, where excellence is the overriding goal and where increasing specialization of knowledge is the primary means to the goal, the average student, sometimes called "the silent majority," can become lost. Multiple conversations, and multiple reports of summer curriculum development projects investigating curriculum and teaching for average pupils and slower learners,[50] attest to the presence of the problem and the continuing struggle to do something about it in science, math, and social studies.

Actually, the labels are used inconsistently and "silent majority" is a misnomer for the overwhelming majority of the high school students are in a college prep curriculum and do go to college. It's almost as though that group is broken into those who are the most able, who are in honors sections of the high school ("Alte U") and who will eventually attend prestigious eastern colleges and technical universities (e.g., engineering schools), and those who will attend other colleges. The strangeness of this was caught by one of the site visitors.

> In the slow algebra class, 12 students actively participated with the teacher in analyzing quadratic equations, while three students looked out the window, or kept their heads on their desks. I was impressed with how quickly the 12 learned the algorithm, and was startled with the realization that in many schools these children would have been academic super stars.

---

[50] On test scores Alte's "slow learners" are average and above on national norms, below average on local norms. The situation is a far cry from tested abilities reported in The Complexities of an Urban Classroom where only three out of 27 youngsters tested above 100 on group intelligence tests.

Another site visitor, after a conversation with one of the science teachers, commented in the report:

> The teacher expressed concern that the courses in the science area at Alte High were too difficult for some students in the school. . . . said that the entire curriculum was designed to make the student think critically. Some could not. There was nothing for these students. [The teacher] felt that something should be done for these students . . . hoped to change this. . . .

Such are the perspectives of two visitors who each spent a day in the Alte Schools.

As indicated earlier, the curriculum in math and science is tracked in terms of prerequisites which have ability and interest criteria. This produces a fair degree of homogeneity in the classes, though less so in the history courses, which tend to have a more broadly based clientele. It produces, though, as the summer curriculum reports attest, the continuing problem and frustration of "what to do with the average and lower ability students." In the day-to-day classroom situation, the multiple excerpts from class protocols scattered through the report suggest aspects of the problem and attempts to cope with it.

While in no way trying to present a solution to that problem, the observer, one day in early May, after watching two beautiful lessons, one (X) with a high ability science class and one (Y) with an average ability class, reflected at some length in the notes.[51]

> (Obs - There's a major difference running through the teaching as I contrast X and Y. Hard to pin down--
> 1. both are on task
> 2. both are helpful - with individuals and total group
> 3. both want kids to learn
> 4. difference in level of difficulty [ideas, vocab, etc.] in pace - one explanation vs. multiple explanations, one problem vs. multiple problems, one illustration vs. multiple illustrations
> in one (Y) more a teacher than scientist

[The observer broke in with an interpretive aside within this broad interpretive attempt to compare and contrast.

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[51]Once again, we are illustrating, methodologically, Atkin's (1973) argument for practice-oriented inquiry. The more intense analyses of the latent implications remain to be spelled out and synthesized with similar approaches in the literature, e.g., Bloom and Broder (1950).

(Obs - More like undergraduate teaching, general education,[52] vs graduate and professional instruction at W.U.)]

5. difference in bounding of units
   a. one (Y) is more common sense and in world-at-large
   b. other (X) is bounded more by scientists' categories
   c. one (Y) is related to things one can do in the world - practical projects.)

In short, the point is that "solutions" for working with the silent majority exist in Alte, in another kind of silent majority, a group of teachers, many of whom tend to be less visible and less legendary than some of their colleagues. Exploring for, communicating about and rewarding those individuals, those teaching strategies, and those settings seems a worthy agenda item for the District and perhaps implicitly for the structure we called earlier a Center for the Analysis of Teaching.

The "A School"

The Alternative High School has been in existence five years. Describing and analyzing it is like trying to clutch a phantom. It is an evolving and changing phenomenon, system, entity. Briefly, when it began several key items were noted:[53]

1. Student initiative was a major factor in its origination.
2. The Alte School News reported: "The request (to the Board) was prompted, the committee reported, because a significant number of students, both academically able and those with problems, have expressed a desire to 'drop out' unless something broader and more immediate as an alternative is offered."
3. An initial maximum size limitation of 5% of the high school population was instituted and has been maintained.
4. The program was to "complement" the regular program.
5. The program of the regular high school was felt by the committee to be "efficient and effective" for the majority of students; but they agreed it was "monolithic and offers only one set of assumptions about learning and that a second choice should be provided students."

[52] It's been a long time since the observer read the Harvard report on general education. Time prohibited returning to that and similar sources and building them into the analysis.

[53] Most of these items are from several issues of the Alte School News.

6. The typical day involved such items as "advisory meeting with counselor, independent options, mini-courses (creative writing, film viewing, contemporary music, Yoga, photography, comparative religion, and nutrition), group dynamics, team project, town meeting, and school project."
7. In the first year the faculty was one full-time teacher and several part-time teachers from the high school.

From those initial characteristics the school has evolved substantially. Currently, there are three full-time faculty, some forty-five students, and an evolving program of studies. An examination of several of the major curriculum thrusts places the program into science and social studies in several interdependent ways. Several strands might be considered:

1. community ideology of the A School, town meetings, values classes
2. community study - history and ecology of a town whose nearby river is to be/may be dammed
3. multifaceted science study - plants, ornithology, Nature Lodge at the sixth grade camp
4. science, poetry, and writing

Briefly, one of the major educational experiences at the Alternative School is the Wednesday morning town meeting. The students and faculty jointly decide the school goals, program, and even who will be accepted in the subsequent year. The more controversial issues which defy solution for the moment are referred to the "values class" taught by an instructor with background in psychology and social science. These discussions are mixed with a variety of activities, exercises, and readings geared toward self-understanding and understanding of others. Much of this fits the contemporary perspective of humanistic psychology. In a sense it's "hands on" social science, in part generated out of real experiences in the day-to-day functioning of the school, and, in part, feeding back into the system. It tends to be more oral and less bookish, more immediate and practical and less remote and theoretical, more group involved and less individualistic than social science at the high school.[54]

One of the larger projects involves a mix of history, social science, science, and language arts. A community study is underway regarding a town which is near a river whose proposed damming is under considerable controversy--locally, statewide, and nationally (e.g., President Carter's current proposals on waterways).

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[54]At this point, there is no intent to argue "better or worse" regarding either end of these continua, only to indicate there are substantial differences between classes at the A School and at Alte High School.

Contacts have been made with community leaders, interviews are being collected (a mix of oral history and survey research), documents are being read, nature studies are being undertaken, and a log cabin in the area is being restored. The product is to be a "magazine"--a report with feature articles, essays, poetry, and pictures. A broad attempt to integrate with language arts and communication.

Finally, brief mention might be made of a host of science activities. The observer heard a good bit about and saw the massive notebook product of a science, art, and literature project, a one-afternoon-a-week for ten weeks journey to an arboretum. Observation, discussion, sketching, and poetry writing produced some exciting results. The affect generated was a major force in the school. Parents commented about both the quality and quantity of the work accomplished by their sons and daughters. This year, week-long stays at the cabin in arboretum have been implemented for pairs of students. Nature observations are recorded through the seasons. Keeping the cabin warm, preparing meals, and living together have been major "curricular items." Other groups have done extensive camping, bird watching, and visiting at conservation centers, swamps, and field stations around the midwest. A course in "plants"--their propagation, growth, and economics (spring sale at the High School)--has involved others. Scraping and tanning deer and coyote hides took the time and efforts of others. Comments were made earlier about the Nature Lodge which was set up at the sixth grade camp.

The most fundamental differences in this kind of science curriculum and that provided elsewhere in the district seemed to be in two dimensions. The hands-on quality here tended to be with problems more of the students' own choosing, although the instructor was involved heavily in discussions which sharpened, clarified, and helped shape the problems. The problems were "more real"; that is, they grew out of ordinary, practical, or everyday experience rather than from more of a theoretical context. Once again, no attempt is made here to argue "better or worse," but rather to pinpoint clearly differences and similarities.[55]

To round out "science education" at the Alternative School, the math tended to be more practical also--essentially basic arithmetic. In one lesson which was observed, the content was a cluster of problems in fractions and decimals taken from a study guide for the G.E.D. tests. The procedures and discussions were not too different from what one might find in many elementary or junior high classes. The students seem to find them more than difficult enough.

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[55]At several points we have tried to indicate the complex valuational/theoretical/empirical analysis needed to judge whether this is "good" or "better" education.

Current opinion of the Alternative School by faculty at the regular high school, and more generally in the Alte Schools and in the Alte community at large, is mixed.[56] Parents of students attending the school are reported to be supportive. In most instances they are pleased to have a school setting which their youngsters aren't resisting. For, in turn, they don't have a daily hassle with them regarding attendance. The importance of this is self-evident to anyone who has been through this experience or who's had close friends or relatives who have.

The mixed feelings of the Alte faculty are attested to from a variety of sources. The high school curriculum guide, for instance, does not contain any reference to the "A" School; recruiting for the school does occur visibly (e.g., signs posted in the corridors) and is supported by the administration. Comments by teachers in committee meetings, "They are a part of Alte High," carry a flavor of implicit separateness and/or exclusion. In turn, the A School faculty sees itself as apart from, and sometimes hostile toward, the regular faculty. The Alternative School students are explicitly negative toward Alte High School. The stuck-up youngsters, the boring curriculum, the domineering faculty, the punitive administration and the general lack of freedom for doing one's own thing are recurring reactions in the school.

At this point, this observer/analyst neither wants to take sides, for the issues are much wider than science education, nor is able to take sides, for the data are too limited. Several final observations, hunches, and speculations might be in order. First, some irony exists in that the formation of the A School was entangled with the Committee to Stimulate Excellence in Teaching.[57] As reported in the Alte School News:

> Two of the budgeted activities are subsidies for innovative programs inaugurated this fall at Alte High School [the Alternative High School] and Alte Elementary School. The committee felt that these programs will have a stimulating effect on the entire staff, whether through the techniques or programs developed at these schools or through teacher-initiated activities as a result of the activities at these schools.

This has not happened between the Alternative High School and Alte High School.

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[56] In part this may be a function of our limited data, of what year of the school the faculty member has knowledge, and the degree of direct personal knowledge possessed by the faculty members. All of this suggests the importance of a careful study of the school: historically, contemporaneously, and through a follow up of former students and faculty.

[57] Our data here are not complete enough to unravel the complexities of the story.

Secondly, much of the discussion and exchange of epithets with and about the A School seems beside the point, e.g., cop out, dropout, spaced out, and so forth vs boring, regimented, authoritarian. The underlying fundamental issue, in this observer/analyst's speculative view, is that the A School represents a fundamental critique of the core values, e.g., excellence as specialized knowledge, and the central procedures, e.g., high-demand, teacher-structured courses and classes of Alte High School, as well as of the relationship between that kind of school and the larger society of which the community of Alte is representative.

But those speculations--right, wrong, or confused--are apart from the more restricted scope of this report. Suffice it to say that some students were unhappy enough at Alte to want something different as their secondary education. The community, through the faculty, administration, and school board, were responsive to those wishes in helping to create an alternative school in which some percentage (and here the figures vary) of the forty to forty-five youngsters are experiencing, among other things, some very novel approaches to science education.

Resources and Their Use

One of the initial, impressive, and almost overwhelming aspects of the Alte School District is its resources. It begins, as has been indicated, with the upper middle class community with its high assessed property base and taxes. The district's per pupil expenditures are in the top ten percent locally and higher statewide and nationally. Such financial resources are converted into low teacher-pupil ratios, materials and supplies (e.g., LRC's), ample physical space, and a variety of pleasant and satisfying working conditions.

An illustration of the working conditions appeared in the field notes:

> I've been out for coffee (10¢/cup) and donuts (brought in by one of the teachers). Teachers' room is air conditioned. Prints of Picasso and Miro are on the walls.[58] Facilities include a lavatory, sink, stove, refrigerator, coffee pots, lunch tables shoved together as one big table. Sofa, chairs, and table for lounge area. Very comfortable.

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[58]While this investigation centered on science education, an equally interesting study could be made of aesthetic education. The prints are reminiscent of the high end of Toffler's (1974) and McLean's (1975) positions. See our discussion in Smith (1977).

In the course of being a participant, the observer kept meeting and being impressed with the personnel called aides, clerks, and volunteers. Brief comments were recorded in the notes.

> Brief conversation with Mrs. Jones. She's a parent with kids at another elementary school in Alte. Had done volunteer work. A friend of one of the teachers. Got on as "clerk." She's a bright, charming, competent woman. Enjoys the kids, the work, the group of adults. (Obs - Another resolution for putting meaning into one's life?) Other aides hired more directly through central office applications. She has not been trained as a teacher.)

The additional strength this brings to the district seems very great. It warrants a separate analysis in its own right.

The material supplies were overwhelming--in the eyes of the observer. One of his academic biases is toward the availability of books of all kinds. To find each elementary school library with five to ten thousand books seemed an unheard of resource. The junior high library with microfilm and microfiche readers and complete sets of the morning and evening metropolitan papers seemed equally astounding. In addition, the elementary LRC's were full of science boxes, math games, social studies materials of multiple kinds--not to mention language labs, spelling materials, and SRA individualized reading sets.

A careful study of the utilization of the materials and facilities was not made. Our "in and out" research style left us with several impressions. The elementary LRC's usage varies some across schools, but generally they hum with activity. The junior high library seemed much less "busy" when the observer was in to write notes between classes or after observations. The high school library was jammed, and according to several teachers, was a facsimile of a student union. The firmness of those comments as generalizations is open to question. The antecedents and consequences are even more provocative.

The most interesting and controversial implication arose in comments from teachers and administrators early in the study. The observer commented on several occasions about "being overwhelmed" regarding the resources. This led to comments of multiple sorts from the Alte staff member. Several staff members, as the discussion proceeded, raised some doubts about the "over abundance" of materials and the twin consequences--inhibited teacher creativity and fostered staff individualism and lack of joint activity. In turn, the observer/analyst speculated about the possible curvilinear hypothesis between amount of resources and teacher creativity and cooperation. Later, other staff members were highly critical of the validity of the hypothesis. Finding unobtrusive measures of resource utilization, of teacher creativity, of faculty cooperation and competition, and of teacher belief systems (e.g., "I can't do this because..."), interrelating them within and across districts, and looking for antecedents and consequences seems a problem worthy of further inquiry.

Conclusion

While these "areas of controversy" exist in Alte, it should be obvious that they are neither overwhelming nor the focus of bitter conflict. In this investigator's opinion they are part of the give and take within and among the major groups within the district. As the district copes with the problems of education, the sides line up and regroup from issue to issue. The larger impression is that of agreement on most things.

TOWARD A SUMMARY AND CONCLUSION

An Overview

At the close of a study, it is often useful to sit back and ask--What has been learned from the effort? For an educational psychologist, that has a certain ironic reflexive quality. Implicitly, it asks for one's concept of learning, how is one different now from before? Essentially it seems to be that cognitive structures are altered in these several ways:[59]

1. a few specific new ideas or elements
2. some finer discriminations in the network of relationships--both hierarchical and causal
3. alterations in the overall integration of the domain of inquiry, i.e., science education in a school district
4. some shift in emphasis, importance, or centrality of particular parts--"bright, bold strands"
5. some pieces isolated more clearly as problems, puzzlements, questions.

The next few pages will review particular substantive issues which seem to fit one or more of these changes. The ideas have their precursors, they are part of an evolving point of view. In a sense, they are personalistic and couched in the form of what the observer/analyst learned. By being grouded in the particulars of science education in the Alte School District and in some more general literature in education and social science, it is hoped that the learnings might be instructive for several audiences--colleagues in Alte, in the CSSE project, in science education, and in professional education more generally.

Tentative Thoughts About An Historical Perspective

The historical perspective on the district's science education program has seemed particularly instructive, even if only partially developed. To see--in the 1890s --that most of the elements, structures, and processes were present in embryonic or rudimentary form may be too obvious to everyone to be called an insightful perception or conclusion. However, the implications sprout in a dozen different ways. What was the direct and indirect influence of the report of the Committee of Ten (1893) on the Alte community and staff at the turn of the century when they began to think about

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[59]Methodologically this has implications on the classical problems of the purposes of research, foreshadowed problems, investigator bias (seeing what one wants to see), criteria for evidence, replicability, generalizability of case study findings, and so forth.

the high school program? What was the impact of the bulletins from the State Departments of Education in the midwest and elsewhere, such as Organization and Administration of Junior and Senior High Schools (Lee 1927)? Was Alte a recipient or was it among "a number of superintendents, principals, and teachers [who] rendered valuable assistance" in the preparation of such statements of standards? Are national and state committees and their pronouncements more or less influential now than fifty or one hundred years ago?

The historical perspective can lead also to a fundamental reworking of one's approach to the very nature of knowledge. Reading Toulmin's and Goodfield's triad of books on the history of science, Architecture of Matter, Fabric of the Heavens, and especially The Discovery of Time, in anticipation of the project was both provocative and unsettling in terms of specific ideas and conceptions in "science" and also in the investigator's own conceptions of social science as it related to CSSE. In the Preface to a later book, Toulmin (1971) expressed it this way.

> The central thesis of the present volume...can be summed up in a single, deeply held conviction: that, in science and philosophy alike, an exclusive preoccupation with logical systematicity has been destructive of both historical understanding and rational criticism. Men demonstrate their rationality, not by ordering their concepts and beliefs in tidy formal structurals, but by their preparedness to respond to novel situations with open minds--acknowledging the shortcomings of their former procedures and moving beyond them. Here again the key notions are 'adaptation' and 'demand' rather than 'form' and 'validity'... The philosophical agenda proposed here sets aside all such assumptions in favor of patterns of analysis which are at once more historical, more empirical and more pragmatic.
>
> (1971, pp vii and viii)

His point of view is a large agenda, indeed. It leaves one feeling more than a bit presumptuous.

People and organizations who want to change other people and organizations should know where the people and organizations have come from, how they are currently structured, and where they want to go. The zoning of parts of Alte into 1 1/2-3 acre lots sixty years ago is a chronicled fact. The interpretations that this led to "executive city" or to the current upper middle class quality of the community and the emphasis on educational excellence is overly simple and open to question. The relevance of this to policy groups such as NSF or NIE and to more local immediate "change agents," however, does seem very great. Similarly Alte's conception of the good teacher is phrased colloquially as the "strong teacher," a person with clear goals for children's learning, high demands, and imaginative ways to get there. Such a

normative structure has been developing a long time, as far as could be ascertained, and is the product or resolution of a number of contending views. It, like many other positions, is not to be "given up" easily.

A Paradigm of District Structure and Process

Some years ago a perceptive social scientist argued that one should focus one's observations on conflict, not for its obvious sensational properties but rather for its proclivity in bringing to the fore latent structures and processes. The description and analysis of IPI and the LRC's seemed to do that very well. The concluding metaphor is that:

> a school district is a quasi-stationary social system (equilibrium?) of contending individuals and groups with different agendas, points of view, domains of interest, and power.

That may not be "news" either, although a review of texts in educational administration and organizations might be revealing. The full implications of the position are not clear, but several suggest themselves, mostly in the form of "A school district is not just. . . ."

For instance, the Alte District is not just

1. a political system--although it is assuredly that in some respects;
2. a formal organization with agreed upon objectives and rational means to reach those, although there are elements of that; too;
3. a community of scholars, although it has many scholars (both faculty and students) who do live together reasonably well (with a few notable exceptions);
4. a coercive institution, even though pupils are required by law to be there; nor totally a remunerative organization, even though teachers are paid to be there;
5. a learning system of inputs, throughputs and outputs, although pupils do arrive at five years, leave at 18, and in the interim learn well, by most criteria;
6. a professional society, even though the faculty and administrators are very much professionals in the best sense of that term;
7. a mechanical system of replaceable parts and pieces, although incumbent teachers do fill certain positions that will remain after they leave;
8. an organic system that grows through God's help and some simple human nurturance; and
9. a legal system, although the district is enmeshed in federal, state, and local laws.

In effect, we are arguing for a point of view of a system of self-determining actors with individual points of view, prevailing interests, and patterns of talents who coalesce into factions and subgroups around issues of the moment. Each of the "nothing buts" is an important but partial way of stating the general position. Further, we are saying that many of the facets of science education in Alte, and perhaps in some other places, cannot be understood nor explained without such a paradigm.

Nature of Science Education

Some images desert one very quickly, others remain vivid and bold. The afternoon the teacher said that"NSF may view science education as math, science, and social studies, but no one in Alte does"is one that has remained. It may be practical for NSF's national policy and legislative purposes to construe science education that way (and perhaps Congress wrote the enabling laws based on such a conception); but other people and organizations, such as Alte, hold different conceptions and solve their problems, for better or worse, with those alternative conceptions.

Substantively and organizationally math, science, and social studies were separate entities in the junior and senior high schools. In the elementary schools this was partially true, for on some occasions project activities brought a reconstruction of knowledge boundaries. These facts played all through the report and the accompanying interpretations. There is no monolithic science education in this district. Neither Hempel nor his heirs live in Alte.

Curriculum: Domains and Dimensions

Early on, an attempt was made to focus "at the district level"; that is, with the district as the unit of analysis rather than at the school or the classroom level of analysis. The guiding, if not telling, questions were: How has the district changed over the years? and, How can one compare one school district, Alte, with fifty other school districts? While one eye was always wandering, the central view was always on science education--as defined by NSF. As the data from documents, conversations/interviews, and qualitative observation accumulated, the patterns which emerged we came to call curricular domains and dimensions. The domains were large chunks--formal curriculum, informal/enriched curriculum, and curriculum-as-what-is-taught. The dimensions included such concerns as excellence, advanced specialization, breadth, and interrelatedness.

These ideas opened up a series of issues. Several remained, for lack of time, nagging puzzlements. We could not make Bernstein's (1971) provocative concepts of codes, classification, and framing work. Whether the mode of thought is different, whether the concepts are at root tangled, or whether we just did not understand them is not clear. For sure, time was not available for the

analysis and synthesis necessary. Similarly a long standing concern for measurement procedures in education vies with the qualitative thrust of our current participant observational mode of inquiry. The insight into the parallelism between our CSSE efforts and the "Evaluative Criteria" came too late to do more than suggest the possible fruits from a careful analysis of that instrument, its underlying theory, and the available empirical data growing from the tradition. We did not have the time to search, codify, and criticize that literature.

The Individual Teacher: Sine qua non of Science Education

This project did not begin nor end as a study of the idiosyncratic teacher. The observer was dazzled by a number of teachers, lessons, and classrooms, only a few of which are recounted in this report. Further, as he sought general dimensions of science education, the people of Alte--administrators, board members, teachers, pupils--always ended up talking about individual teachers. Usually these were categorized into a large minority who were intellectually imaginative, exciting, and creative and usually humane but sometimes egotistical and prima donnaish. An early summary observation and interpretation phrased it thus:

> One isn't in the district long before one hears the names of particular teachers mentioned by other teachers in staff rooms, by administrators and by parents. This seemed an interesting twist on the isolation, the autonomy-equality patterns discussed in some of the literature. I was first struck by this when the names of elementary teachers were mentioned across buildings--"S/he is doing a lot of that," or "S/he is kind of the district expert on that" or "S/he started that in the district." In the junior and senior high schools the same phenomenon occurred, but often with quite visible symbols. "S/he won the 'teacher of the year' awards from this or that state or local group." "His/her kids made 5's on the AP tests." "S/he's particularly good with average kids." And "His/her kids are always coming back with grins and thanks for what they've learned and how helpful their class was." And "S/he is teaching at X College or in Y summer institute."

At the other extreme were a smaller group who were perceived as stale, uninteresting, dull, burned out. Without solicitation, and independently from different individuals in different schools and positions and from different parts of town, the same names in the same categories would come up. The agreement was surprising. Perhaps, as some argued, Alte is a small district. Perhaps reputations are a kind of stereotype. Perhaps, as has been argued in the analysis, Alte has some agreement, a set of norms regarding the nature of the good teacher. Further, Alte has a number of public and semi-public events when a teacher and "what s/he can do with children" are on display. Recall, for instance, the sixth grade

camp with several dozen staff members--teachers and administrators from every school in the district, from most of the subject matter areas and with a sprinkling of aides, secretaries, and central office personnel. And an unsolicited comment later while having coffee in the faculty lounge at one of the schools: "She's a hard act to follow." This is not to mention field trips, district-wide art fairs, and spring PTA festivals.

The possibilities for theoretical and empirical analysis of the idiosyncratic teacher arose throughout the project and throughout this report. Like many good problems it is a chestnut. With exemplars as vivid as some of the teachers in Alte, with organizational structures such as the proposed Center, and with the multi methods of observation, clinical method, and practice- oriented inquiry, the chestnut seems amenable to another round of roasting. That is a major problem.

Items of Debate

The Alte School District is an intellectually stimulating place to be. The areas of controversy, except for IPI, seem to flow around, and mostly by, science education. We were tantalized by the hypothesized curvilinear relationship between resources and teacher creativity. So few places are as well off economically as Alte that seldom does an opportunity exist for thinking in those terms. If it is more generally true, it would become an interesting item in the cognitive structure of an administrator as he works with his department, his school or his district. The continuous coping with youngsters of average ability is a story with a long history in Alte and one whose ending has not been written. We kept seeing partial resolutions, some of which have been noted. Those are difficult to communicate, are susceptible to the erroneous reaction ("I'm already doing that"), and seldom seemed clearly perceived and discussed by larger groups of the staff. The Alternative High School is more a splinter under the thumb nail than a stimulus for excellence on the entire staff, which some of the early visionaries hoped for.

Concluding the Conclusion

In concluding the conclusion, one might note the items mentioned earlier. In this investigator's opinion, one should learn something from research; that is, one's cognitive structure should be altered. Further, one of the changes should be an alerting of oneself to novel problems and their solutions. The array of observations and interviews produced a host of images of idiosyncratic efforts at science teaching and glimpses of the complex three dimensional personalities from which these arise. Clarifying those relationships and clarifying the intricate logic of altering those relationships seems the most fundamental issue, the next and most important foreshadowed problem raised by the present inquiry.

APPENDIX I

Methodological Notes: Some Premises of Procedures

Time ran out on this methodological appendix. Instead of a coherent integrated essay addressing the special issues of the CSSE experience as it relates to and extends our previous case study procedures, this is a collection of snippets, ideas born but not developed.

Origins of a project

Research strategy and tactics have complex roots and origins. As one goes back to old notes one encounters numerous forgotten items. For instance, in the fall semester before the project formally began, the observer visited a former student, now a junior high principal in New Suburbia, a middle-middle class district, and he also participated in a three-day Northcentral evaluation of a local high school. Figure A-1 is an outline of notes made then, three months before the case study officially began. Eight months later,

Insert Figure A-1 about here

in the middle of analysis and writing, idea number one, data sources, was well implemented. Number two, local and national standards, was finessed in the sense of the localist emphasis and the science education emphasis. The interdependency of local, state, and national goals was too big and broad a target. Item three, cross district observations, went the way of limited time. However it was indirectly implemented in that a major question for the site visiting teams was always, "How do you see Alte in the context of fifty other districts or schools in which you've spent time?" Comparison groups can be generated in multiple ways.

The major points, however, are: (1) the research begins before "the project" begins. To neglect this, not to keep notes from this "real" beginning, is to lose foreshadowed problems and procedural tactics; (2) Sources of stimulation arise in all kinds of experiences and activities. To ignore these is to lose some of one's potential creativity and originality; (3) All this is a restatement and partial extension of Glaser and Strauss' (1967) discussion of theoretical sensitivity.

Choice of Alte

The Alte School District was chosen for two sets of reasons--one substantive to the project and one personal to the investigator.

1. Data and documents that would be helpful re CSSE Project
    1. North Central reports--especially over time
    2. Local histories of community and school
    3. Yearbooks
    4. Documents for parents and kids

2. Major foreshadowed problem lies in
    1. local goals and standards and national goals and standards, that is, "judge in terms of own goals"
    2. the chance to think this one through in a specific discipline and a specific community

3. Tactics in studying Alte might involve lesser visits to nearby districts
    1. District X
    2. District Y
    3. District Z

Figure A-1. Verbatim items from field notes "before" CSSE study began (10/5)

Substantively, it is a small, upper middle class suburban school district with a reputation for having a good science education program. We coded it as Alte because it was an older suburb (i.e., Altevorstadt). As such it fits the larger perspective of the ten sites of CSSE wherein categories of urban/rural/suburban, large/middle/small, regional (north/south, east/west/middle west), lower/middle/upper middle class districts have been relevant to the choices.

On more personal grounds, the district was chosen because it was small, nearby, and staffed with administrators and teachers known to the investigator. These factors were conditioned by the project's brief time schedule in which data collection, analysis, and write up were to be accomplished in a single semester by a single investigator working half-time. It was felt that prior professional acquaintance and trust would facilitate the work. This methodological hypothesis seems amply supported. In innumerable ways, the observer's path was broken, smoothed and facilitated. "Old home week" was a recurring experience.

Other aspects appeared. The pleasure in seeing, visiting and exchanging reminiscences and ideas with former students and colleagues was "a real plus." It met some long-felt needs of the investigator, who has lamented the lack of an effective mechanism for keeping in touch with M.A. and Ph.D. students who have stayed in the local community. We have no organizational mechanism as effective for us as AERA is on the national level.

In addition, several of the Alte staff had been trained earlier by the investigator in participant observer techniques. They knew the methodology as skilled practitioners "from the inside out." They flooded the investigator with their perceptions, documents, and entry to situations fraught with theoretical provocativeness. In some unusual and extra way, the report belongs to them more than is usual, in my experience, to the participants in prior research.

The two-edged sword phenomenon

Early on, in the choosing of Alte as a possible site, one of the chief concerns was the brevity of the allotted time. One way around that was to go where one knows and is known and trusted. Entry times are speeded. Access to valid data is easier. A backdrop of knowledge, facts and interpretations is implicitly available for developing hypotheses and foreshadowed problems and for comparing and contrasting new data as it comes in. This issue came up in preliminary discussions of research tactics and strategy with the superintendent who had had, some years before, considerable experience in field research (although not with the present investigator). The note on that conversation contained the following point and aside:

> Also discussed some of the negative aspects of being too close to the people in the district and taking liberties as research one wouldn't ordinarily do. (Obs - a good point.)

The "two-edged sword" seemed an appropriate label and it became an item in discussions with most of the "old friends" we encountered in the district. Being conscious of it, bringing it out into open discussion, urging people to speak out if and when they felt they were being compromised, became part of the continuing dialogue.

To the best of my knowledge, the only major violation, if it really be that, was taking large chunks of time for extended interviews. One of these, which was partly "catching up on old times and acquaintances," ran three hours; others averaged better than an hour. In partial defense, it may be more the methodology than the prior acquaintance because several other interviews ran between one and a half to two and a half hours with staff I had not known previously.

A further aspect of the "two-edged sword phenomenon" in the analysis and write up is a tendency to "overcode" for anonymity. He's become she's, her's become his's, and so on. Incidents lose specificity in time and place. Interesting dyadic and triadic interactions become group discussions. In a sense the narrative loses some of its particularistic punch and the account loses the possibility of internal self consistency in validation, extended case analysis or situational analysis as Van Velsen (1967) calls it. Contrasts can be seen with our earlier reports in Complexities and Anatomy.

Sampling

The logic of sampling in participant observation has not been worked out well. Malinowski's early advice on "being around for the events of everyday life" is an early principle. More recently, Glaser and Strauss speak of theoretical sampling. Our work (e.g., Smith and Pohland 1976) has been evolving, in part toward a position which might be called descriptive sampling. By this we mean that at a common sense or layman's level of analysis, the domain can be broken up into sub-domains and each of these can be covered. Early on, we built a chart of the territory and a way of cycling through. This is Figure A-2.

Insert Figure A-2 about here

This plan vied with and eventually lost in part to an earlier plan. Before agreeing to do the study the observer checked informally with several staff members he had known and worked with before. "Will it fly in your domain?" was the question. Each saw no major problems. In the back of the investigator's mind was an earlier sampling notion--"At a minimum, if I can work in detail in at least one of the elementary schools and either the junior or senior high school, I can piece together a narrative and analysis." As time problems mounted, the observer found himself retreating to two of

Sampling Domains

1. Principals

2. Schools and teachers

3. Classes and teachers by weeks

	Cycle 1	Cycle 2	Cycle 3	Cycle 4
High School	Sci	Soc Sci	Math	Alternative High School
Junior High	Team 1 7th	Team 2 8th	Team 2 7th	Team 2 8th
Senior High	School A	School B	School C	School D

4. Elementary Curriculum Committee
   Science, Math, Social Studies

5. High School Committees Preparing for Northcentral Evaluation
   Policy, Math, Science, Social Studies

6. Special Circumstances
   1. Citizens, school board members
   2. Knowledgeable professionals who have contacts in the district
   3. Faculty meetings, P.T.A. meetings, etc.
   4. Special events, programs, activities

Figure A-2. An early sampling plan

the elementary schools, one of the junior high schools, and parts of the senior high school. In that sense the focal data came from several schools; the other buildings and parts of the system were sampled more briefly--mostly to check out ideas developed in the more intensively studied schools.

This kind of sampling was soon coordinated with the time and effort of the site co-ordinator and the site visitors who spent considerable time in the district and tended to concentrate in a particular school or two and a cross section of programs. That too evolved out of some dissatisfaction with site visits elsewhere in CSSE and the personal/professional needs and possibilities of project personnel. Such visits greatly increased "the coverage" and also the range of comparison districts available for contrast. CIRCE's contacts are national and international; so too were the site visitors.

Perhaps the most critical part of sampling in obtaining a valid picture of the phenomenon under study is who determines what situations are observed.[1] In the discussions of informed consent with the staff, the question came up regarding the frequency and timing of observations. In general, the point was made that no teacher would probably be observed more than a few times because of the size of the district and "the K-12, science, math, and social science scope" of the project. This seemed evident and reasonable. Another usual question arose as to "when would the observations be made?" The observer argued again the size and scope aspect, and stated his preference to "pop in" unannounced and as convenient. This, too, was received as reasonable. Requests were made to try to come at the beginning of a lesson and stay through its entirety (especially in the more time-bounded junior and senior high schools). This too seemed reasonable and was honored. The point to be made here was that these arrangements permitted the observer to guide his selections randomly, comprehensively (in one school all teachers were observed), or hypothetically (in pursuit of a particular issue). It precluded teachers or administrators guiding the investigator into those classes, committees, or activities which they thought appropriate for whatever purposes. In fact, only one meeting was closed to the observer; the bigger problem was too little time to be everywhere. In turn, this led to more reliance on interviews--multiple perceptions of individuals who had been in various "everywheres."

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[1]Some aspects of these points arose in a fruitful discussion with Eleanor Farrar of the Huron Institute. We were comparing her reservations about her observations and my more "ultimate" faith in mine; and our varied reliance on interviews of several kinds.

When it's not possible to come and go as the research evolves, the data suffer and, in turn, so do the description and the theoretical interpretation.

Unanticipated time demands

Our experience has been that in spite of careful planning the activity of research always springs surprises, both methodologically and conceptually. Making adjustments, then, toward a synthesis of thought and action is part of the creativity and joy (and frustration) in the research. One of the biggest surprises was three kinds of unexpected time demands:

1. securing written statements of informed consent
2. coming to understand the point of view of large numbers of teachers
3. having a supervisory/site review team involved.

The research had been planned for a tight time line, one semester--in, out, analysis and write up. The time constraints, the unexpected time demands, became a rack inflicting considerable stress.

Much of the observer's recent work has been in the context of larger curriculum development and implementation efforts of CEMREL, Inc., one of the Regional Laboratories. The concerns of informed consent lay with the larger organizational and interorganizational commitments, agreements and "memoranda of understandings."[2] In the CSSE study, the investigator went through several layers and domains of the organization:

1. the superintendent
2. the principals
3. the department chairmen of the high school
4. each department in the high school separately
5. the junior high school
6. each elementary school separately
7. scattered individuals in the schools and community.

In effect, some 10-12 group meetings were scheduled, trips were made to have the forms available beforehand, and presentations of the project were made and discussions entertained. Some were as brief as ten minutes (when the principal had introduced it at an earlier faculty meeting) and some as long as an hour, when the social studies teachers probed critically. Most of January was gone before this was accomplished. It did generate some early overview

[2]In retrospect, I think to some degree I neglected or minimized individual responsibility in these instances.

observations and interpretations that had considerable value. Further, it did solve well the "Who are you?" and "Why are you here?" kinds of problems. Finally, it accomplished its intended purpose, informed consent.[3]

The "Vignettes of Teachers and Teaching" illustrate the second time demand. Initially the observer felt that he could "do" three or four observations per day. In a sense he was extrapolating from earlier studies, e.g., Complexities and Anatomy. What happened in effect, was that the observer was confronted with:

1. a new "three-dimensional" person each time;
2. a particular lesson, piece of content, embedded in a larger, often sophisticated, context;
3. some of that context on occasion was text authored by a teacher, or a notebook indicating his/her conceptions of knowledge in science;
4. some idiosyncratic approaches to teaching which were creative to the point of "blowing one's mind";
5. a particular group of youngsters with unusual talent and intent; and
6. a dozen different schools.

Trying to understand each teacher, administrator, staff member, see him/her from his/her own perspective and in the context of department and school was overwhelming. Somehow each should be in a lengthy, intensive inside/outside relation as was Geoffrey in the Washington School. Somehow the internal dynamics of each school needed the time and attention we gave to Kensington. After each observation and interview, the experience needed to be savored, reflected upon, explored, and recorded. Time. There was never enough time.

Lastly, there were the time demands of a supervisor/co-ordinator and his legions of site visitors. It's been a long time since the observer had had someone "looking over his shoulder." The co-ordinator was an old friend. One of the reasons for agreeing to join the project was the opportunity to work with the project director and personnel. We talked and talked and talked. Sessions ran until as late as one in the morning. The content ranged from his books to my books, his research styles to mine, his conceptual structures and processes to mine. The topics included concepts and definitions of explanation, latent models and metatheories in in educational research, cognitive structures and processes versus more general personality theories and processes, physical science and social science. We observed together and we interviewed together. And we talked. We observed separately and we interviewed

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[3]Issues remain in professional obligations and organizational obligations and implicit coercion when a superintendent or school board grants approval. A teacher who declines must have serious objections.

separately. And we talked. It's been a long time since I've had such an excellent tutor and have learned so much.

It wore us (me) out. It took time from teachers, pupils, classes, and schools.

What we needed from NSF was a year's time for reflection, argument and synthesis.[4]

The site visitors must remain anonymous. Each contributed significantly to the data on Alte. One vignette illustrates well the time demand. Late in the semester the co-ordinator wanted to bring in one last visitor--a retired headmistress from U.K. "The fatigue, the press of a few final visits and interviews, an itch to get on with the analysis and I have to put up with another visitor, and a little old lady principal to boot," were the thoughts going through the observer's mind. Then he met her. The four-hour dinner discussion was an exquisite treat. She was as perceptive an observer as I'd ever run into. In the conversation she would comment, "I talked with this boy, and he said something curious... later I noticed the teacher did/said...," and then she would reach for an inference--often one I'd been struggling toward for weeks. Shortly, she made an allusion to "Miranda," and as we blinked and tried not to look dull, she launched into a few minutes on the Tempest and Shakespeare's treatment of the character whose personality was generally similar to but subtly different from the case we had been presenting. This then led to recollections of several interviewees who had been a part of her earlier research project. Their problems and outlook, so she related, were only partially caught in the statistical analysis, cross-tabs and measurement data they had in the study. And all of this was cloaked in a language so precise, so colorful, so full of images. Later, when I did the homework I should have done before, I found our library had three books of hers. There may be more. She writes as beautifully as she speaks. The interview quotes are selected perceptively, juxtaposed with the artistry of a fencing master making the fourth and fifth touches without an intervening parry. The literary allusions and the telling inference appeared on the first page and continued throughout.

Each visitor took time we did not have, yet we did not have time enough with them. Exciting and stimulating, but doubly frustrating.

In another perspective, these unexpected time demands constitute one of the most important side effects of participant observational research--the intimate contact with fascinating people engaged in fashioning their own existence, sometimes with skill and grace and sometimes with troubling struggles.

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[4]A related frustration was minimal time and opportunity to interact with the other site observers. A six or ten week retreat in the summer of '78, with reports, file of data, theories and recommendations would be helpful.

The mix of observations, interviews, and documents

Since we began doing field work some years ago, we have been committed to triangulation or multi-method/multi-concept/multi-situational approaches to data collection (Smith and Pohland 1974, 1976). Illustratively, we have found it more productive to observe an event (e.g., teaching and learning in a history class or the give and take of faculty meetings) and then to talk with participants. At a minimum it gives us a common concrete referent to ground our elusive abstract educational language. In addition, it helps keep everyone honest about realities and ideals.

One of the best illustrations of the triangulation occurred this way. The investigator had observed and taken part in an assembly at one of the schools. As several of us were on the way out, one of the teachers, visibly upset, was "reading out" a group of kids presumably for their noisy inattentive behavior. It was not possible to follow up on it at the moment. Later, in a more general discussion with several other teachers, I recalled the incident, asked what had happened and heard an extended account of the interrelation of other assemblies and this one ("the worst all year"), concerns for the teachers who had planned and developed it, actions by administrators and staff regarding an upcoming program which was full of humor and zest and which in their eyes had the potential for "getting out of hand." A variety of substantive issues in staff morale, organizational processes, school goals were present in the illustration. The main methodological point to be made is that the observation of the particular situation came back a month later as the stem of a question in a discussion and pulled a variety of quite concrete and meaningful items regarding the school.

Similarly, in talking to one of the administrative staff, a reference was made to the public opinion survey conducted in the district. As he commented about different aspects of the program the observer was able to interpret his remarks in terms of the specifics of the report. At other points specific information was available from the Alte School News, which provided an agenda and context for remarks by staff on district-wide events. The array of documents available and consulted are included in Figure A-3.

Insert Figure A-3 about here

In a sense the interplay of observation, interview, and documentation in studying science teaching can be represented in a flow chart of people over time. Typically, the observer would receive a few minutes of orientation--location in sequence, text, today's lesson--just as class was beginning. Then he would observe for an hour. If there was laboratory work or in-class homework or assignments, the teacher would often float by for a few minutes for a bit more explanation as s/he was making the rounds of the pupils and helping them. At the close of the hour we would often

1.	Texts, lab manuals, teaching materials	
2.	Alte Professional Evaluation	1976
3.	Alte Enrollment Forecast	1976
4.	Alte Staff Handbook (Continuously Revised)	1977
5.	Alte Curriculum Guides	1958 - 1977
	math science social studies	
6.	Alte School News	1962-
7.	Local newspapers	
	Morning News	1977
	Evening News	1977
8.	Outdoor Education Documents (state and local)	1976-77
9.	Surveys and Reports by Outside Consultants	1975-77
	IPI Community Survey of Citizens	
10.	Reprints of articles, news notes, etc. that friends thought I might be interested in	1976-77

Figure A-3. Major Documents Consulted

talk for a few minutes more. In some instances if the teacher had a free period we spent twenty minutes to an hour. In other instances this was the first of a number of brief contacts over the semester, and on occasion, lengthy interviews/discussions about science education and related items. Into these came a variety of documents

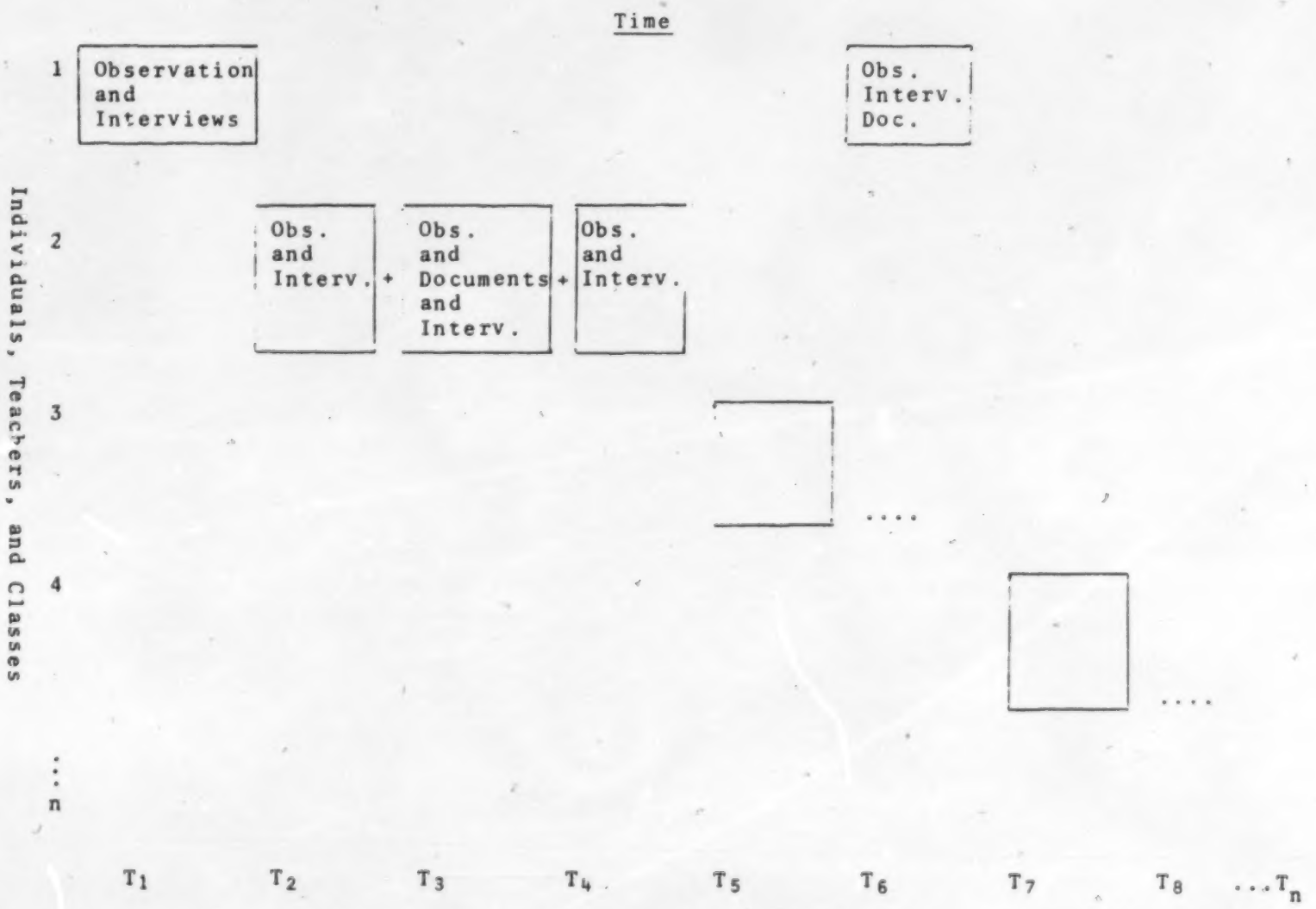
Insert Figure A-4 about here

as well. The implicit view of social reality and the relevant methods for approaching that reality seem very important.

Exit Interviews

One of the variations in procedures for us this time was engaging in a series of "exit" interviews. These were lengthy interview/discussions--usually about an hour, although one lasted two hours and fifteen minutes. They occurred mostly in schools where we had spent a large amount of time. They involved initially a general overview by the individual member--usually from his/her position and perspective as teacher, principal, counselor, superintendent, board member, parent, or citizen. Secondly, the discussion would move toward specific points, relevant to the interviewee's position on which the interviewer sought further clarity. Finally, in several instances, concepts, hypotheses, and interpretations of the observer would be tried out, debated, and explored. That is, attempts would be made to see if the phenomenon existed, e.g., "staleness," and whether alternative conceptualization were possible, e.g., "long term lack of creativity." Further, antecedents, consequences, and interventions would be explored.

In many instances, these interviews turned out to be mutually exciting, stimulating, and lengthy. On occasion overtures were made to terminate them, e.g., "I've taken enough of your time," but an idea hadn't been explored fully and the interviewee would finish a ten-minute point and then find him/herself stimulated by another related issue which had to be clarified if the earlier point was to be clearly understood. The observer was impressed again and again by the interviewees' ability to carry long involved threads of thoughts through multiple illustrations, minor side issues and back to the central point. Provocative but exhausting. Currently we are trying to integrate this kind of interview with other aspects of participant observation.



3-125a

Figure A-4. Interplay of Observations, Interviews, and Documents Across Teachers and Occasions.

Generating Analytical/Theoretical Conceptions[5]

One of the most frequently posed questions in ethnographic research is "the formula" for generating analytical/theoretical conceptions or interpretations. In thinking through aspects of the development of CSSE, that is, while we were suffering through the process per se, a number of items arose, some of which we have highlighted before.

1. Foreshadowed problems: Always we seem to have an agenda of questions from students, from personal concerns about teaching/learning, from reading, from our earlier work. A number of these are listed as part of Appendix 2.

2. Immersion in concrete perceptual images: This is really a question of how much raw data does one have. The day in and day out involvement in the setting produces an ocean of images of the phenomenon, a wealth of particulars--people, situations, events, occasions, etc. The human condition in all of its varied, idiosyncratic, unusual, mundane, exotic aspects plays itself out before one's eyes.

3. The interpretive aside: Along the way, a variety of ideas, insights, interesting associations of ideas, events, people arise. We tend to jot these down into the notes (Obs - ...). Later they become key points in developing the analysis. They seem to "pop out" in the normal give and take of observing and talking with people in the setting. Often they have a free associational quality..."reminds me of..." and sometimes they are simple perceptual comparisons or contrasts.

4. Conscious searching: Concomitantly with the almost unconsciously determined items of the interpretive asides (item #3), there is the omnipresent question, "What does it all mean?" This is a search for overall patterns, for broad themes which seem to break the phenomenon into large chunks or domains. This is an active searching for order. Sometimes, as with the historical emphasis in the CSSE case study, it came early (from reading Toulmin in general and Westbury in particular). It seemed to "keep working for me" both methodologically, in guiding toward interesting data, and substantively, in turning up interesting problems and perspectives. It finally became a major theme (section #2) of the report. Further, it left me with a bit of unresolved tension in

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[5]This discussion benefited greatly from the comments of my Spring '77 seminar.

the form of "Next time, or soon at least, I want to do a for real historical study." With a bit of luck that may be in the offing. That brings one back full circle to a foreshadowed problem (in this instance, a mix of problem and procedure) and means that that study is already cracked open enough to have a beginning point of attack.

5. Similarities and differences: The essence of concept formulation, and somehow I'd never quite seen it back in the days when I was administering the Wechsler and WISC is, "How are they alike and how are they different?" As items appear in the perceptual images, as verbal comments are recorded, as situations appear, as events come and go, one asks a simple two-sided question--How are they alike and how are they different? The similar things are grouped and given a label that highlights their similarity. The different things are grouped, insofar as possible, and given labels. There always seems a large "miscellaneous" category of items which seem important but which don't fit anywhere. The "seem" is critical. There's always a hunch lurking behind the "seem" and given more data, more time, and more thought, the pieces find a place in relation to one another. Earlier we called this the "jigsaw puzzle analogy."

6. Concurrent outside activities: During any project a number of things seem to be happening concurrently in one's life. Single strand existences don't exist. During CSSE I was

1. at a conference in Germany which pushed me to read Decker Walker's book--and Westbury's chapter and also involved me with a variety of people and points of view. Some were new, some were old, both as individuals and from their scholarly work.[6]

2. already reading Toulmin and Goodfield who had been suggested to me years ago as an overview to the history of science.

3. chance reading - a graduate student had been talking about Sheehy's Passages.

4. in a GIE committee, evaluating assistant and associate professors and all the problems of "effective professing" of which "effective teaching" was one major element.

5. at AERA-symposium and conversations with old friends.

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[6]A conference report, Theory and Practice in Educational Research, was published by the Institute für Didaktik, University of Bielefeld in 1976.

6. in seminar at GIE, everyone doing a p.o. project or case study. Mine was CSSE. Free for all in these.

7. Project press: As mentioned elsewhere, the short time line on CSSE produced enormous pressure to move quickly, to begin intensive attempts at conceptualizing early to seek workable outlines. This produced a series of stresses, some of which were toward conceptualization and interpretation.

8. Formal Analysis and Writing: Finally, in the end of May, and all through June, reading field notes, the summary observations and interpretations, and the multiplicity of documents produced the intensive search for order and the final patterns presented in the writing.

Implicit in other parts of the report and the appendix, one can find other remarks which round out the biography of the project.

Conclusion

In conclusion, these snippets must stand in for a more developed essay. But vignettes have their own kind of potency and perhaps they will suffice. The interested reader might consult several earlier sources. In Complexities we wrote a long introductory chapter and appendix on methodology and procedures. Concepts and issues such as foreshadowed problems, basic guiding, constructs, interpretive asides, two realities problem, and model building are all revised. In Anatomy we scattered the methodological issue throughout--as the index indicates. Paul Pohland and I tried to come to grips with Glaser and Strauss in a paper published in 1976 but written a decade earlier and in the appendix to the Rural Highlands Study (1974). Finally a scattered series of papers and symposium addresses (Smith 1967, 1974, 1977) clarifies further our methodological position.

Finally, we have wrestled with and been guided by a number of field workers: Homans (1950, 1962, 1967), Malinowski (1922), Becker (1952, 1961), Bruyn (1967), Glaser and Strauss (1967), Denzin (1970), McCall and Simmons (1969), Whyte (1955), Iannaccone (1962), and Van Velsen (1967). All of them kept speaking to, answering, questions that we kept running into. Perhaps the most amazing experience has been re-reading some of the early favorites, i.e., Homans and Whyte, and finding how much they had learned and had to teach the second and third time through, several years later.

APPENDIX II

CSSE - A Small Suburban District: Preliminary Plans[7]

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January 1, 1977

1. Introduction

It has been my experience that a brief introductory overview of problems and procedures of an observational research project has been helpful as an initial point of departure for the observations, a reminder of the original focus (the forest) when the trees of data are everywhere, and as a gyroscope for the later analysis when intriguing side issues loom large.

2. Foreshadowed Problems

The original purpose by NSF and CIRCE investigators lists an array of problems to which we'll attend. At a more personal level, several additional items appear which I'm eager to have the data speak to.

2.1 A number of issues in the nature of science, its history, methods, formats of results, goals, and so forth. Briefly, the list includes positions taken in the following books:

Toulmin and Goodfield - Fabric, Architecture, Discovery
Hempel - Aspects of Scientific Explanation
Scriven - Primary Philosophy
Maslow - Psychology of Science
Ziman - Public Knowledge
Homans - Nature of Social Science Theory
Diesing - Patterns of Discovery in Social Science

In effect how do the relevant groups (citizens, board, administrators, teachers, and pupils) conceive of and operationalize into programs the various possible conceptions of science?

2.2 A number of issues in science education, teaching, curriculum, learning, and development. Typified by articles and books by:

J. Schwab
D. Walker
E. Anderson
M. Otte
L. Shulman
P. Hirst

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[7]This project is supported by NSF. The project is a subpart of CSSE, principal investigators are Professors Robert Stake and Jack Easley.

2.3 A number if issues in school organization and governance
- a. citizen and school board influences
- b. teacher committees, reference groups
- c. articulation between elementary, junior, senior high programs
- d. alternative schools

A variety of people come to mind here:
- Smith and Keith
- Lortie
- Charters
- March and Simon
- Bernstein.

3. Procedures

3.1 "Standard" participant observation technique will be used.

3.2 The major unit of analysis is the school district's science program. The accent is on both the "district" and "science program." In turn, these break into level of school, subject areas, teachers, pupils.

3.3 My initial hunch is to focus concurrently on the high school, the junior high, and one elementary school. Perhaps this will be done best by "waves," that is, a week's cycle at each level and back again.

3.4 Many of the educators in the district are colleagues, former students, and close personal friends. My hope is that this will make for ease and flexibility of entry observation and interviewing. The greatest difficulty will probably lie in making the final report honest and critical where necessary - if it implies negative judgments on friends.

3.5 Historical contextual aspects and unobtrusive measures from school yearbooks, North central evaluations and other documents, library usage, counselor comments and records, follow up studies and so forth, will be noted.

3.6 Because of the interrelationships with other elements of CSSE, my hope is to implement the "memo's" strategy we used in the AEP X Pilot Study. Essentially these were vignettes, tentative interpretations, and questions and asides that were occurring along the way. This had aspects of formative evaluation and presaging of the final report. At a minimum, these should appear once a month, that is four or five times during the semester; they may be considerably more frequent. An added aspect of this kind of reporting lies in the brevity of the project; the final report is due almost immediately at the close of the semester, rather than six to twelve months later.

4. Results

4.1 Our usual procedure has been to accent description and analysis, that is, an overview in lay language of the phenomenon (science education in a small suburban district) and a theoretical interpretative analysis. That still seems reasonable although it may be interpreted or focused in terms of NSF's overriding concerns on its current status of science curriculum and science teachers' activities they have supported in the past.

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